Memory for story-like material

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MEMORY FOR STORY-LIKE MATERIAL

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"I'll make my report as if I told a story, for I was told as a child...that Truth is a matter of the imagination. The soundest fact may fail or prevail in the style of its telling....The story is not all mine, nor told by me alone. Indeed I am not sure whose story it is; you can judge better. But it is all one, and if at moments the facts seem to alter with an altered voice, why then you can choose the fact you like best; yet none of them are false and it is all one story."

Ursula Le Guin, 'The Left Hand of Darkness'

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DECLARATION

None of the material contained in this thesis has previously been submitted for a degree at any educational institution.

PUBLICATIONS

Parts of the present work, in earlier versions, have formed the basis for the following papers:

Cornish, IM (1975). Memory for stories. Postgraduate seminar paper, Department of Psychology, University of Durham, 28 May 1975.

Cornish, IM (1976). Memory for story-like material. Paper presented at the Postgraduate Psychology Conference, University of Durham, 28 May 1975.

Cornish, IM (1978). Memory for prose: quantitative analysis of recall components. *British Journal of Psychology* 69: 243-255.

Cornish, IM (1980a). The effect of three instructional sets on the recall of story-like material. *British Journal of Psychology* 71: 91-94.

Cornish, IM (1980b). Verbatim recall in memory for prose. Paper presented at the annual conference of the British Psychological Society, Northern Ireland Branch, Rosapenna, County Donegal, 4 May 1980.

Cornish, IM (1981). Verbatim recall in memory for prose [Abstract]. *Bulletin of the British Psychological Society* 34(4): 134.

STATISTICAL NOTE

Throughout this Thesis, Edwards (1968), McNemar (1969) and Winer (1970) have been used for reference on parametric techniques, Siegel (1956) and Leach (1979) on nonparametric techniques, and Cohen and Halliday (1982) and Cooke, Craven and Clarke (1982) for both. The computer programs referred to in Chapter 6 for calculating contingency coefficients and simple cluster analyses were written entirely by the author. The latter is reproduced in Appendix 5.7.

ACKNOWLEDGEMENTS

This thesis is a belated account of research I carried out in the University of Durham between October 1973 and September 1976. I have received help from many people, as subjects, independent judges and sources of advice, support and much needed pressure over the past decade, though space allows me to mention just a few by name.

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ABSTRACT

MEMORY FOR STORY-LIKE MATERIAL - I.M.CORNISH

A series of experiments was performed using the free recall of short story-like passages and a variety of analytic techniques to investigate two aspects of the mental representation of text: the nature of the encoding, and the structural relations among information in memory.

The verbatim component of recall was the most variable across several factors, declined fastest after a moderate interval but was unresponsive to the recall accuracy demanded by instructions. It seemed to represent the most accurate information rather than any specifically verbatim encoding. Qualitative analysis demonstrated that verbatim recall was strongly determined by lexical and contextual constraints. Substitutions tended to be higher frequency words, supporting semantic decomposition and the loss of finer components of meaning. The mental representation appeared to consist of information on a number of levels of detail and accuracy, with no evidence for discrete propositions.

The literature indicates two alternative approaches to structural factors in discourse comprehension. 'Text-led' theories employ structures peculiar to text and stress causal relations as organising factors. 'Knowledge-led' theories base organisation on the structure of corresponding information in semantic memory and predict that thematic relations, whether causal or not, will dominate memory. Evidence from clause recall contingencies and simple cluster analyses supported the 'knowledge-led' position. The differential behaviour of 'narrative' and 'nodal', apparently organised around verbs (activities) and nouns (actors or objects) respectively, was also consistent with knowledge-led processing.

The implications of the results for selective processing during comprehension, and for the role of working memory were discussed. An attempt was also made to identify possible semantic memory structures which might be responsible for organising the episodic representation of information derived from text. Though still sketchy, the present framework is consistent with several recent lines of research and provides direction for future investigation.

CHAPTER ONE

MEMORY REPRESENTATION

1.1 INTRODUCTION

The purpose of the work reported here is to investigate the mental representation of the information derived from text. Two fundamental and interrelated aspects of text representation will be identified for study: the nature of the encoding in memory, and the structural relations which organise the representation.

Extended prose (or 'discourse') has a number of features that make it an important topic for cognitive psychology: it represents complex, organised information; it is an extended use of language; and it has reasonable ecological validity (but see Neisser, 1978). These factors have grown increasingly important in memory research over the past decade and a half: compare, for example, the contents of volumes edited by Norman (1970), Tulving and Donaldson (1972) and Bobrow and Collins (1975). All three focus on the structure and organisation of human memory, but there is a rapid shift of emphasis during this crucial period towards complex structural descriptions of memory itself and towards a reliance on increasingly more extended and naturalistic experimental materials.

Structure is one feature that has dominated cognitive research into discourse processing and which distinguishes it from the immense body of research with isolated words. It is usually assumed that the large-scale structure in discourse is different *in kind* from that present within isolated sentences, and the basis of this structure is a major focus of interest (see Chapter 3). Most aspects of discourse comprehension and remembering seem to depend on organisational features. Perhaps it is for his failure to describe the actual structure of his texts and for proposing only a vague theory of memory organisation that Bartlett's (1932) account of story recall had such little impact at the time.

However, describing the superficial structure of a text is not the same as identifying which features are of psychological importance. This distinction marks psychological research out from the burgeoning areas of text linguistics (Dressler, 1978; De Beaugrande and Dressler, 1981) and discourse analysis

(Stubbs, 1983; Brown and Yule, 1983). In order to investigate these features, certain restrictions will be placed on the experimental materials used: they will be written texts (ie coherent passages intended to be read) rather than extracts, or conversation or its transcription, and will be narrative or descriptive in content, rather than passages of argument. This material is described as 'story-like'. These limitations will be justified in Chapter 4.

This chapter will deal with general issues of memory encoding and organisation, leaving special consideration of *text* until Chapters 2 and 3. Chapter 2 will look at those structural features of text from which mental organisations might be built, and Chapter 3 will look at more global models of text processing.

1.2 MEMORY ENCODING

Verbatim memory

The simplest theory of memory for discourse might state that only the original words are encoded in memory, and it would be wrong. The work of Sachs (1967,1974) and Jarvella (1970,1971; Jarvella and Herman, 1972) has indicated that in listening to discourse, only the wording and syntax of the most recent information, lasting for about 7 seconds or one or two clauses, is retained in memory. This seems due to the operation of a short-term store or input buffer which holds incoming information temporarily until there is enough for further (semantic) processing, after which literal or surface information is lost (Clark and Clark, 1977; Hitch, 1980). Undoubtedly something similar is happening in reading (Kleiman, 1975; Baddeley, 1979; Hitch, 1980), and Glanzer, Dorfman and Kaplan (1981) provide added confirmation from studies of both listening and reading.

On this evidence alone, it should be impossible to retain any appreciable amount of verbatim (or other surface) information from extended prose, unless repetitive (rote) learning strategies were employed. Where verbatim recall of whole texts does occur, presumably as a result of rote learning, it differs fundamentally from ordinary remembering (Rubin, 1977). However, several different kinds of surface information from prose material may be retained in long-term memory. Physical features, for example, can be remembered some time after reading sentences (Kolers and Ostry, 1974) or listening to discourse (Fisher and Cuervo, 1983) and can cue the recall of words from a visually displayed text (Lovelace and Southall, 1983).

It is clear that verbatim information may be present in recognition memory several minutes after the presentation of sentences (Anderson, 1974). Hayes-Roth and Hayes-Roth (1977) showed that subjects could use verbatim information from sentences in a later verification or recognition task, and argued for a theory of memory representation that was either word-based or that incorporated verbatim ('lexical') information. Anderson and Paulson (1977) also found a degree of persistence of verbatim information in long-term memory with sentences, claiming consistency with a propositionally based model. Similarly, when subjects were asked to judge whether simple diagrams were consistent with earlier descriptions, Mani and Johnson-Laird (1982) found that indeterminate descriptions produced better verbatim memory whereas meaning was better recalled from determinate descriptions.

Studies of extended discourse too have demonstrated significant long-term retention of the original wording of passages (Perfetti and Garson, 1973; Garrod and Trabasso, 1973). Thorndyke has confirmed these results, though was unable to relate his findings to structural features (Hayes-Roth and Thorndyke, 1979; Yekovich and Thorndyke, 1981). Hayes-Roth and Hayes-Roth (1977) reanalysed Sach's (1974) data and discovered that verbatim information had persisted for considerably longer than she had originally claimed.

Context and setting are also factors in verbatim recall. In a rare study of real-life conversation, Keenan, MacWhinney and Mayhew (1977), found that sentences with high 'interactional content', ie which were associated with considerable pragmatic information, showed good verbatim recognition. This seemed unrelated to arousal and minimally related to personal involvement (MacWhinney, Keenan and Reinke, 1982), but may be restricted to sentences which are conventional in phrasing already (Gibbs, 1981). Kintsch and Bates (1977) found that verbatim memory for jokes and other information irrelevant to the content of a lecture was retained over several days, whereas that for lecture content was not. Stevenson (1980) has also failed to demonstrate verbatim memory for lecture content.

While much, perhaps most, of the actual words of discourse may be forgotten fairly quickly, long-term retention of verbatim information can be seen. In social situations it appears that only information connected with the interactions among participants is remembered this way, but some results suggest that a degree of verbatim information is retained from isolated passages. This may be due to highly accurate memory for meaning, which necessarily reconstructs the original wording, or to verbatim recall *per se*, but few studies have yet to tackle this issue.

Memory for grammar

The recall or recognition of verbatim information from discourse often preserves word-order, thus retaining the original syntax too. Syntax is also 'surface' information. Most studies of verbatim memory are therefore just as much studies of memory for syntax. The role of grammar in sentence comprehension has given rise to a very large body of research since 1960, largely due to the discovery of Chomsky's (1957, 1965) work by psychologists (eg Miller, Galanter and Pribram, 1960). Two particularly influential ideas have been that grammatical rules often correspond to mental processes, and that memory representations may reflect syntactic structure. A consideration of syntax is probably not essential in understanding the larger scale aspects of discourse processing, nor to the study of resultant memory structures, except where models of memory organisation have incorporated syntactic structures (Section 1.3). Among the latter, psychologists have tended to prefer 'case grammars' (eg Fillmore, 1968; see also Winograd, 1983) to Chomsky's (1965) 'deep structure'.

Prose research has often investigated the role of different parts of speech in memory, particularly adjectives, verbs and nouns, and there may be some connection between them and structural features of text. Gomulicki (1956) observed how adjectives began to be omitted before verbs and nouns as passages for recall became longer. King and Cofer (1960) claimed, on uncertain experimental evidence, that the ratio of adjectives to verbs within a passage had an 'ideal' value which recall tended to preserve. Adjectives attached to grammatical subjects are better recalled than those attached to objects (Ehri and Muzio, 1974), and are less well remembered than nouns (Morris and Reid, 1972). Finally, Wearing (1973) found that verbs give lower verbatim recall than nouns.

The grammatical role of words in discourse does at least partly determine how well they are remembered, though no overall pattern emerges except for the poor recollection of adjectives, perhaps a product of their lower structural importance. Support for this idea comes from a study by Loosen (1981) who found that subjective judgements of the importance of words in sentences correlated highly with their probability of recall. The subjects of verbs were judged most important, and among content words adjectives were rated the least important.

Propositions

Propositions are "the smallest units of meaning that assert things about the world that might reasonably be judged true or false" (Anderson, 1981: 124). According to Rumelhart and Norman (1975: 44): "propositions express facts about concepts, objects, activities, and the relationships of those three". Typical propositions are single noun-predicate relations. This idea of a proposition has formed the basis of many theories of how information from sentences is represented in memory (Clark and Clark, 1977; Anderson, 1980) and of memory models more generally. Propositions have inevitably been assumed to be the structural unit in discourse comprehension too (eg Kintsch, 1974; Thorndyke, 1975a) though defining them has raised problems:

1. A few authors have defined propositions more loosely, to give a unit that

may be larger and more like a clause: for example, Thorndyke (1975a) and Franks, Plybon and Auble (1982).

2. Propositions are usually defined *a priori* and have rarely been subject to *detailed* empirical test; Kintsch (1976: 91) in fact has described them as a "tool for the investigation of prose memory".

3. Propositional descriptions of discourse have difficulty in expressing global, general or 'Gestalt' information.

These issues will be discussed further in Section 1.3 and Chapter 3.

One important feature of propositions is that they are abstract, semantic units of a rather formal nature, whereas long-term memory appears to contain additional kinds of information. As noted already, Anderson and Paulson (1977) and Hayes-Roth and Hayes-Roth (1977) have argued that some non-propositional, specifically verbatim, information must be contained in the memory representation derived from discourse. Mani and Johnson-Laird (1982) also suggested a separation of verbatim and semantic information in memory and ascribed them to propositional and 'mental model' types of encoding respectively, the latter being constructed from the former. The curious point here is that they explain verbatim rather than semantic information in terms of propositions.

Despite the attention paid to propositions as a unit of information processing, most of the evidence for their validity originates in experiments with isolated sentences or restricted conceptions of text (see next chapter). For example, Franks, Plybon and Auble (1982) investigated the recognition of auditorily presented sentences overlain by white noise, using various combinations of words in the test and acquisition items. They concluded that the unit in memory was the proposition (actually, simple clauses), rather than the concept (content words) or larger organisations of information. This agreed with work by Ratcliff and McKoon (1978) using semantic priming. It is reasonable to suppose that experiments with more complex and realistic materials than those used by Franks et al. might reveal larger units of processing more easily. Anderson (1981) reviewed the literature on the validity of concepts, propositions and schemata as 'cognitive units' and concluded that the proposition was reasonably well established, but that the evidence for the reality of schemata, though strongly suggestive, was not yet so clear.

1.3 MEMORY ORGANISATION

Network models

Over the past decade or so a number of complex theories of the structure of long-term memory have been proposed which share many basic features. Collectively they may be described as 'network' or 'neo-associationist' and as 'models' rather than theories. They are models because their primary concerns are describing a large number of memory phenomena and forming the basis for computer simulations, rather than the rigorous empirical testing of specific predictions against those of alternative theories. In consequence, they have tended to evolve by the continuous modification and the *ad hoc* accretion of ideas derived from a wide range of research. Network models are, in fact, an example of what Miller (1978) has called 'theory development' as opposed to the alternative, more traditional 'theory demonstration' approach.

In the early and mid- 1970's four network models became particularly influential:

1. The 'LNR' Group model: Rumelhart, Lindsay and Norman (1972), Norman and Rumelhart (1975), Norman and Rumelhart (1981).

2. 'HAM' ('Human Associative Memory'): Bower (1972), Anderson and Bower (1973, 1980).

3. Kintsch's model: Kintsch (1972, 1974), Kintsch and van Dijk (1978).

4. Anderson's 'ACT' system (for 'Adaptive Control of Thought'): Anderson (1976, 1983).

All these models include a long-term memory representation consisting of interconnected propositions and structured according to ideas taken from work on semantic memory (eg Collins and Quillian, 1969) and linguistics (eg Chomsky, 1957; Fillmore, 1968). To this have been added other features such as control processes, routines for matching and acquiring new information, 'spreading activation', and memory buffers. Anderson's ACT model also introduces a distinction between 'declarative' and 'procedural' knowledge, being factual memory and a set of skils and routines respectively.

From a strictly empirical standpoint, the network models have been less than satisfactory. Inevitably, the boundary between *developing* such a theory to cover known results and *testing* it against fresh data has often been disconcertingly hazy. Experimentally, the LNR group have favoured factual questions while Bower and Anderson have mostly preferred sentence recall. Only Kintsch's approach, discussed in Chapter 3, has been developed specifically for discourse. The others would claim to be applicable to discourse or text because of their scope, but their broad, eclectic nature and avoidance of rigorous testing makes them less than useful for present purposes.

Evaluation of network models

A detailed evaluation of network models is not justified here (see Anderson, 1976, for a review), but some findings which contradict their basic assumptions are of interest. The models' general similarities mean that criticisms of one may often be taken to apply to the others. Two major issues are:

1. Whether the components of a sentence (or picture) are encoded as all-or-none units or as linked but separable components, and whether there are higher order units of encoding too.

2. Whether non-semantic (verbatim or spatial) information is also present in the memory representation.

Of these, (2) has already been covered in the discussion of verbatim recall, while (1) comprises two variations on the idea of Gestalt wholes or schemata. One of the assumptions of the early network models, in particular HAM, was that propositions were encoded as an interconnected set of concepts and each concept was potentially an independent unit in recognition or recall. Numerous attacks were made on this position.

Jones (1974, 1976, 1978) modified an experiment on cueing effectiveness from Anderson and Bower (1973). His results supported a 'fragmentation hypothesis' in which an item was coded in memory as a "unitary and symmetric [in cueing terms] combination of a particular subset of the item's attributes" (Jones, 1974: Section 1,4). Such 'fragments' behaved in an all-or-none fashion, not as a collection of separable concepts, and did not always correspond to an objective description of the stimulus, whereas network models tend to assume that they do. Jones claimed that his theory accounted for Anderson and Bower's results better than HAM did. Anderson and Bower (1980: 236-7) accepted that Jones' theory "does better than the original HAM model", and admitted that HAM had encoding problems, but they were unhappy about aspects of Jones' theory. Ross and Bower (1981) compared a 'fragmentation' model with two other associative theories on the recognition of sets of weakly related words. The fragmentation model came out worst. Neither of the alternatives did particularly well, though Ross lnd Bower favoured a 'schema' approach which included higher order units of encoding.

Other research has suggested that memory works in terms of codes larger than the constituent concepts of propositions. Anderson and Bower (1972) compared the predictions of an early version of HAM against those of a 'Gestalt theory' for the recall of pairs of sentences having a common grammatical subject. According to Anderson and Bower (1973: 340), the 'main experiment' of that paper confirmed the associationist position (concept as unit). In fact, the 1972 paper reported several experiments of which two were incidental learning tasks (arguably more realistic and less likely to induce rote memorisation). In both of these the Gestalt position was supported, although in one the pattern of results "salvaged" the associationist position, as the authors put it at the time. Foss and Harwood (1975) confirmed a Gestalt position in two similar experiments, claiming that their findings were inconsistent with any associationist model.

In a more recent study using sentences, Goetz, Anderson and Schallert (1981) also found support for a Gestalt position and showed that the proposition is the unit in sentence recall, regardless of the semantic relatedness existing between propositions in the same sentence, ie that there were no cognitive units either smaller or larger than the proposition. Nevertheless, while the reality of the proposition as the basic unit in sentence memory seems well established, the existence of larger units is difficult or impossible to assess unless considerably more complex material is employed.

1.4 CONCLUSIONS

Representation

The encoding and organisation of information in memory are inseparable issues. The proposition appears to be a cognitive unit in this organisation, but under a restricted set of circumstances: memory (usually recognition) for sentences over short time intervals. This leaves open the question of how propositions themselves are structured or encoded, and several different functional units may become evident under more complex or realistic conditions. In particular, the *gradual* loss of semantic information is not adequately explained by discrete propositions, and material varying in complexity from quartets of distantly related words to pairs of overlapping sentences hardly provides an opportunity for higher level or global representations to emerge. Perhaps it is because so many uncertainties remain about encoding that the precise nature of the associations or structures in memory have been left relatively unexplored.

The status of verbatim information remains ambiguous too. Hayes-Roth and Hayes-Roth (1977) proposed an associative model in which words, rather than concepts *per se*, were the components of propositions. Such a theory would probably have difficulty explaining the different rates of loss of verbatim and semantic information: the simplest requirement would be a second, deeper, more general level of semantic representation, as suggested by Mani and Johnson-Laird (1982). These authors claimed that propositions contain sufficiently accurate information to allow the reconstruction of verbatim information, and this may be equivalent to a 'word-based' model (cf Anderson and Paulson, 1977).

Unfortunately, most psychologists have not appreciated the difference between verbatim recall from a verbatim representation, and verbatim recall from a highly accurate semantic representation which permits no alternative lexical expression. Clearly the existence of verbatim information in the long-term mmory representation of text is a fundamental issue, because its implications for the nature and behaviour of propositions. If there is *no* independent verbatim level of representation, verbatim information at ricall can only have been produced by a detailed semantic representation, so that studying such recall should tell us about propositions themselves. It is interesting to note that Anderson's latest version of ACT (Anderson, 1983) contains three quite different 'representational types': 'temporal strings' (which might include words), 'spatial images', and 'abstract propositions', from which other cognitive units may be constructed.

It might be expected that research using text would show up deeper levels of representation (higher order codes). Any residual verbatim recall in these circumstances might be a better argument for an independent verbatim level of representation. The evidence for higher order codes in memory for discourse will be reviewed in Chapter 3, although it is worth noting that Anderson (1981) concluded that propositions and schemata (much larger organisations of information) were probably only *quantitatively* different. This does not help in defining either, and whether the 'proposition' used as an analytic unit by experimenters corresponds exactly to the 'proposition' used as a cognitive unit by subjects must remain an open question because investigations of the latter have usually made prior assumptions about the former.

Processing strategies

One difficulty with using discourse instead of sentences is that its more extensive and more varied structure might provide greater scope for variations in subjects' processing strategies, as have already been observed. For example, Anderson and Bower (1973: 224-234) presented subjects with a mixture of active and passive sentences, as either a coherent story or a jumbled passage. Subjects given the story, while remembering more, were actually poorer at recognising whether sentences had initially been active or passive, a possible effect of different processing strategies (see also Loftus and Loftus, 1976: 113). Similarly, Mayer and Cook (1981) found that subjects asked to shadow a passage remembered as many facts as those simply listening to it, but had higher verbatim recognition scores. The obvious interpretation is that two distinct processing strategies are in operation, reminiscent of Craik and Lockhart's (1972) distinction between maintenance and elaborative rehearsal. This is much like the explanation that Mani and Johnson-Laird (1982) give for their findings. It follows that any experiment on memory for discourse must attempt to control subjects' acquisition processes.

CHAPTER TWO

COMPONENTS OF TEXT STRUCTURE

2.1 INTRODUCTION

Text has structure, and some structural features have more psychological importance than others. Recent work on structural models of discourse comprehension and representation has somewhat overshadowed research on the specific components of structure, but there is value in considering such features in isolation because of their implications for the models reviewed in Chapter 3. In particular, it is perhaps premature to construct large-scale models for text processing when so much uncertainty surrounds the components from which the models are constructed.

2.2 THEME AND TOPIC

Introduction

In Hirst's (1981: 51) definition, "the THEME or TOPIC of a discourse is the main entity or concept that the discourse is ABOUT - the subject central to the ideas expressed in the text". In practice the theme of a passage is embodied in the repetition of an aspect of content (ie 'topic') or the continued discussion of points related to that content. The importance of theme or topic in discourse structure has been repeatedly stressed by both linguists and psychologists, and a great deal of research with sentences and text has confirmed that it is a major determinant in remembering and comprehending prose. There are three likely reasons for this:

1. Structural: thematic relations link propositions or sentences and help to organise discourse.

2. Processing: during comprehension, subjects pick out the 'topic' of a passage and attend to subsequent information according to its relevance to this topic.

3. Pragmatic: in ordinary conversation it is topic or theme that participants are interested in learning about or which the situation constrains them to discuss.

The linguist Halliday (1970: 160-161) stressed the importance of thematic structure in language when he wrote:

> "The basic unit of language in use is not a word or a sentence but a 'text'; and the textual component in language is...to use language that is relevant to the context. The clause...has...what is known as 'thematic' structure."

Theme (as opposed to 'rheme') was defined by Halliday as the first part of a clause, a narrow, technical sense, referring to the topic of a single clause or sentence; but this meaning is closely linked to 'topic' and 'theme' used more broadly (see Brown and Yule, 1983).

Ordinary conversation depends upon thematic structure. Schank (1977) explored the structure of conversation, and found that his analyses were dominated by rules for handling topics and topic-shifts, admittedly on a local level. Mastery of these rules, he considered, was essential for taking part in any sort of conversation. This problem of conversational coherency has been approached on a more global level by Reichman (1978), who substituted 'context spaces' and their constituents for 'topics'.

Sentences and theme

Perfetti and Goldman (1973, 1974) took sentences in which the subjects and objects would, in isolation, have been equally good retrieval cues, and placed them at the ends of paragraphs. When the grammatical subject was also the thematic subject of the paragraph, equal cueing powers of subject and object persisted, but when the object became the thematic subject, it was a better cue than the grammatical subject. One interpretation of this finding is that, in the absence of indications to the contrary, the grammatical subject of a sentence is assumed to be the thematic one too, (cf Halliday, 1970). Loosen (1981) found that the best recalled word in a sentence was its subject and that judgements of the importance of words in a sentence agreed very well with their recallability.

Sasson (1971) compared the relative effectiveness of different ways of organising sentences in a factual (historical) passage on subjects' recall. He found that thematic organisation (repetition or continuation of topic) was best, and temporal organisation worst, as an aid to learning. Other workers have encountered contradictory results in the recall of information from passages organised by names (corresponding to topics) or by attributes. Di Vesta, Schultz and Dangel (1973) found that concept name organisation was better; Myers, Pezdek and Coulson (1972, 173) found attribute organisation superior, and Frase (1973) concluded that they were equally effective. It should be noted, however, that these three studies, unlike Sasson's, employed very list-like passages, composed of sentences that were little more than name-attribute pairings.

Several studies have looked at the recall of target sentences within a passage. For example, Bruning (1970) varied the context provided for sentences by the rest of the passage: both relevance and organisation (ie whether scrambled) aided the recall of test sentences. In contradiction to this, Frase and Kreitzberg (1975) found that prior presentation of the first few *words* of a sentence facilitated its recall from text, whereas prior presentation of its *topic* did not. This paradoxical result might be explained by the instructions the authors used (eg "learn the information in all of the sentences...") which could easily have biased subjects towards surface processing or rote learning.

Text and theme

More direct evidence for the importance of thematic identification on text processing comes from an experiment by Kieras (1980) in which subjects had to say what they thought was the main idea of a passage in which a sentence expressing the main idea came either at the beginning or in the middle. Subjects' stated themes were more accurate for the former. Kieras (1981b) claimed that marking out certain items in a passage as 'topic' and 'nontopic' did not affect how much information was stored in memory, but suggested that "topic marking is an aspect of the passage that the subject stores more or less independently of the propositions retained". This is reminiscent of Bartlett's (1932: 206-207) use of the term 'attitude', a "general impression of the whole" which a subject recalls first, subsequent recall being "a construction, made largely on a basis of this attitude".

Consistent with the idea that recall can use thematic information is an unusual study by Neisser and Hupcey (1975). They relied on subjects' everyday encounters with Sherlock Holmes stories and found that subjects identified the source and context for sentences most accurately when the sentences were closely related to a story's theme. Effectively altering the theme of a passage *after* presentation can alter recall too, as demonstrated by Anderson and Pichert (1978). Here, an ambiguous passage was presented to subjects under one of two 'perspectives', and after ordinary recall it was found that additional information could be remembered when subjects were asked to attempt recall again under the alternative perspective. Flammer and Tauber (1982) performed an adaptation of this experiment and showed that, for optimum recall, the recall perspective must be consistent with the reading perspective. Clearly, the theme subjects assume at recall can affect how memory is accessed.

Supplying themes

One way of varying the topic relations among the sentences of a passage is by providing subjects with a prior orientation or expectation about the theme of the passage. This can take the form of titles, pictures or summary information. All can aid or bias memory and comprehension. Bartlett (1932), in fact, had found that subjects persistently labelled both pictures and prose for themselves as part of the process of comprehension. Curiously, he was rather dismissive of the effects of *supplied* titles on memory.

Hall (1950) was one of the first to show that the presence or absence of a (supplied) title strongly affected the direction and amount of recall from narratives. Dooling and Lachman (1971) gave their subjects a particularly difficult and ambiguous passage, and discovered that recall and recognition were greatly aided by an explanatory title. This study was replicated by Bransford and Johnson (1973) who noted that an irrelevant title had a slightly depressing effect on recall. Further confirmation was supplied by Schwarz and Flammer (1981) who found that a 'thematic' title aided the recall of well structured texts; the recall of unstructured passages was enhanced, but only if subjects were allowed enough time to read them.

Pictures can operate like titles. For example, Bransford and Johnson (1972, 1973) found that an explanatory picture facilitated memory for a highly ambiguous passage much like a title. One major criticism of their work is its dependence on extreme and highly contrived situations, but at least they demonstrated that the phenomena 'worked'. Unfortunately, this is not always the case, as Vernon (1951) showed in classroom situations where illustrative graphs actually *hindered* the recall of accompanying passages of argument.

The effect of preliminary information on learning from discourse has been intensively researched over the years, especially from an educational viewpoint. The most influential approach has been the 'advance organiser' concept of Ausubel (1960). An advance organiser is a piece of prior information (typically a summary of main points) about a prose passage which "must provide or locate the meaningful context" and "encourage the learner to use that context during learning" (Mayer, 1982: 62). However, Ausubel's 'subsumption' theory from which the concept of an advance organiser derives (eg Ausubel, 1963) is couched in such ambiguous and tortuous terms that it can provide no detail about the structural properties of text, the mechanisms underlying discourse processing or the resultant memory structures.

Experimental tests of advance organisers have encountered problems too (eg Ausubel, Stager and Gaite, 1968; Wulf, 1974). Clawson and Barnes (1975) highlighted the main difficulty, which seems to be trying to define what an 'advance organiser' actually is, and Hiller (1974) suggested that the objectives supplied by an organiser often conflicted with those implicit in the passage itself. Mayer (1979, 1982) in otherwise positive reviews of research in this area, has admitted that definition is still a major problem. This probably arises from the nature of Ausubel's 'theory' which is oriented more towards practical application than underlying cognitive processes. Reder and Anderson (1980), investigating the effect of summaries (albeit long ones) outside Ausubel's framework, actually found that students learnt the main points of a text better from the summary *alone* than from the original text. This benefit was later ascribed to both spaced practice and the absence of distracting detail (Reder and Anderson, 1982).

The lesson from these experiments is that, despite its importance to comprehension, subjects normally have some difficulty abstracting the theme or main topics from discourse; under normal circumstances, therefore, giving any kind of thematic information in advance is likely, but not certain, to enhance recall.

Conclusions

Thematic information and relations are important determinants of how people comprehend and remember both isolated sentences and text. Extracting the theme of a passage is not always easy, and it appears that forewarning subjects of the theme of a passage enhances memory for the information in that passage, whether the forewarning takes the shape of a title, a summary or a picture. Research has explored some of the limits of this phenomenon, but it is probable that adequate explanations could be offered from several different theoretical perspectives. Theme also seems to be effective as an aid to remembering at the time of recall.

It has been widely assumed that ascertaining the topic or theme of a passage, and employing this to interpret or attend to the information within it, is a fundamental part of discourse comprehension. For example, a recent study of recognition memory for important and peripheral information in skimming newspaper stories, has indicated that subjects are able to attend selectively to information only at the level of semantic processing, and that attention at this level is governed by the theme of the passage (Masson, 1982). The problem of how people resolve references in discourse is closely related to the comprehension of theme, since thematic relations on a local level are typically mediated by anaphors (see below). One illustration of this is Tyler's (1983) discovery that thematic structure played an important role in children's resolution of references within text, especially of younger children.

There are two separate issues in the structural role played by thematic information:

1. The importance of (local) thematic or topical relations in the formation of structures.

2. The existence of 'high level' thematic codes in the memory representation of discourse, perhaps having a controlling function during processing.

Both have implications for the mechanisms underlying discourse processing. For the time being, however, it is to other aspects of discourse structure and to more global descriptions of discourse (some of which incorporate processing components) that attention must be turned.

2.3 OTHER STRUCTURAL FEATURES

Temporal relations

Temporal relations among the elements of prose passages have seldom been an object of enquiry in themselves. Temporal relations form part of narrative structure, but they have usually been confounded with causal ones. Causal relations produce better remembering than temporal ones in the same passage, measured by the amount and organisation of recall (Mandler and Johnson, 1977). When temporal relations are the main structuring principle in a factual passage, recall is much poorer than when organisation is along thematic lines (Sasson, 1971). What evidence there is suggests therefore that temporal relations *per se* have at best a weak determining role in discourse processing.

It might be argued that the 'temporal' relations studied with prose material are really just sequential relations and are unconnected with temporal relations as they enter memory for everyday experiences. It appears, however, that even in everyday remembering people do not use or remember a purely temporal framework: a few key events are dated accurately, and the times of others are calculated by reference to these anchor points or 'landmarks' (Loftus and Marburger, 1983). In normal prose there are far fewer opportunities for this relative dating to occur, and it would almost always be confounded with other factors. In addition, subjects' temporal codings are likely to be very different with discourse, since there has been no actual *experience* of the time periods involved. It is reasonable to suppose that temporal relations in prose do not give rise to genuine temporal codes, and subjects probably treat temporally organised information as little more than a list.

Causal relations

Causal relations within discourse can take many forms. Actions, changes of state, events and other outcomes may be said to be caused by goals, states or actions and so forth (Trabasso, Stein and Johnson, 1981). Many models of discourse structure and comprehension have stressed the importance of the 'episode', which is basically a goal-action-outcome sequence (eg Thorndyke, 1975a; Schank and Abelson, 1977; Kintsch and van Dijk, 1978), though some have described episodes in more complex terms (eg Mandler and Johnson, 1977). Episodes may therefore be described as causal chains.

Schank (1975) proposed that both text and human memory are organised around causal chains, and Rumelhart (1975) suggested that Schank's chains might represent a stage in discourse processing immediately *prior* to that addressed by his own story grammar. Causal chains alone produce linear organisations, and though all discourse is superficially linear, evidence that the memory representation derived from text contains higher order units and hierarchical groupings seems incontrovertible (see Chapter 3). A causal chain analysis can only be a preliminary one.

Gentner (1976) compared a causally-based story grammar (containing hierarchical features) with a structure based on the serial ordering of elements within a passage, in analysing subjects' recall. The serial structure was the most effective predictor of immediate recall, but the story grammar became dominant later; if this is interpreted as the selective loss of more superficial information, then Rumelhart's contention is borne out. Interestingly, Gentner's story grammar probably includes a higher degree of sequentiality than Rumelhart's. According to Kemper (1982), there are only four permissible causal connections in prose, constituting an 'event chain taxonomy': other apparent causal connections need inferences to make sense. Her subjects were quite capable of making these inferences, but their behaviour too indicated an awareness of hierarchical and episode structures which lay outside the taxonomy. Inferences about the consequences of an action can also be drawn, during the actual reading of text (Singer and Ferreira, 1983).

There is direct evidence that causal links *per se* enhance memory (Mandler and Johnson, 1977). Black and Bern (1981) noted that most models of narrative memory posit memory structures that contain episodes as components. They demonstrated that recall from an episode was affected by the episode's length but not by the length of adjacent episodes, and concluded that episodes formed discrete units ('chunks') in memory. This was confirmed by Haberlandt, Berian and Sandson (1980). Haberlandt et al. also claimed that encoding time was greatest for the episode constituents at the boundaries between episodes, explaining their result by the cognitive load produced when subjects switch from one episode to another. Graesser, Hoffman and Clark (1980) also investigated the structural factors within text and their contribution to the varying cognitive load during reading. They found that subjects seemed to devote more processing effort to relations among sentences ('macrostructure') than to relations within sentences ('microstructure') and that the two levels of processing could be separated out by appropriate experimental manipulations.

Not all the components of causal sequences have equal status (Haberlandt et al., 1980). Bower (1982) reported that his subjects judged the goals pursued by the protagonists in a story to be the most important episode constituents and found that rated importance correlated with recall. The problems created by stories containing two or more correlated or interacting goals have been explored by Wilensky (1978a), and Bruce and Newman (1978). Causal relationships may therefore give rise to quite complex structures.

Logical relations

Logical relations, set-theoretic or syllogistic ones for example, have rarely been studied in discourse comprehension, though causal relations and inferences might be said to involve logical operations. Dawes (1966) assessed subjects' recognition and recall for the reproduction of nested and disjunctive relations present in the original passages. Memory for set relations was quite poor, but relations of this kind are probably a minor aspect of discourse structure.

It might be thought that passages of argument would feature logical relations more prominently than other types of material. Bartlett (1932) was surprised to find that such passages were very poorly remembered, even by highly educated subjects, despite the high degree of structure present in them. One of the few recent studies of memory for passages consisting solely of argument was conducted by Marcus (1982). She found that hypothetical assumptions necessarily made during the course of an argument were less well recalled than facts, and that facts arising out of an argument were less well recalled than those with which it began. Marcus interpreted her results in terms of a model for argument proposed by Johnson-Laird (1975), though this seems to have little utility for our present needs.

Anaphora

Discourse comprehension often requires people to interpret references to information elsewhere. Reference may be made to information outside the discourse, in which case it does not constitute a structural feature. For example, Clark, Schreuder and Buttrick (1983) studied the resolution of ambiguous demonstrative reference, which was only explicable in terms of considerable common knowledge between the persons interacting. Internal ('endophoric') references do lend structure, however, and have been extensively studied (eg Clancy, 1980; Clark and Marshall, 1981) and processing accounts offered (Kieras, 1977; Sanford and Garrod, 1982).

One particularly important type of reference in discourse is anaphora, which has a central role in text structure or 'cohesion' (Halliday and Hasan, 1976; Hirst, 1981). Anaphors help mediate other structural relations, particularly thematic ones, and theme is an important factor in their interpretation (or 'resolution'). Hirst linked anaphor resolution closely to the theme of a piece of discourse and to its current 'focus' (those preceding items which can still be referred to at a given point in a text). Focus is related to what is held in consciousness, ie it involves some sort of working memory. Lexical, pragmatic and thematic factors are all involved in anaphor comprehension (Tyler, 1983).

The overall effect of anaphoric relations on text comprehension can be readily demonstrated. Referential continuity (the sharing of a referent by adjacent sentences) considerably aids memory for brief descriptions of spatial layouts (Ehrlich and Johnson-Laird, 1982). Garnham, Oakhill and Johnson-Laird (1982) found that replacing anaphoric pronouns by their referents partly counteracted the memory decrement arising from structural disruption of passages, which would destroy most anaphoric relations.

Many recent investigations of anaphora have focused on how antecedent information is activated in memory, usually assessed by semantic priming effects in word recognition. For example, McKoon and Ratcliff (1980) discovered that anaphors activate the whole of the proposition containing their referent and claimed that the referent and the anaphoric proposition were connected in the memory representation. However, it appears that only the referent remains activated while the rest of the sentence is read (Dell, McKoon and Ratcliff, 1983). Corbett and Chang (1983) found that in disambiguating pronouns having two possible referents, subjects accessed both referents in memory, ie they did not rely on what could be inferred from context. This seems to diminish the role of theme, but may be a function of the test situation.

The given-new distinction and bridging

Another type of reference is involved in the distinction between 'given' and 'new' information, originally proposed by Halliday and introduced to psychology by Haviland and Clark (1974). They argue that sentences contain both old (given) and new information and that the position of an item indicates which kind it is. Typically, the old information comes first, but the order can be modified. This 'agreement' between listener and speaker, to provide both kinds of information in a sentence and to signal them accordingly, has been called the 'given-new contract' (Clark and Haviland, 1977). The identification of new with antecedent given information is not always direct, however, and may require extra information, not present in the passage. This additional information is provided by the subjects' making 'bridging inferences'.

Sanford and Garrod (1981) have reviewed the possible mechanisms underlying the identification of given and new information. Cues such as articles which signal whether items in a sentence are old or new actually affect the processing of individual words (Irwin, Bock and Stanovich, 1982). Constructing bridging inferences also takes time and slows the rate at which information can be comprehended (Haviland and Clark, 1974). Vande Kopple (1982) investigated the validity of the given-new distinction with complete texts (previous research had been biased towards sentences). 'Topically linked' passages, in which the topics or themes of each sentence were all closely related to each other in various ways, were better remembered and more easily understood than non-topically linked passages, which tended to confound the given-new principle. Vande Kopple claimed that subjects added new information to the node in memory already occupied by the given information. Other work on inferences and their memorial consequences implies that bridging inferences might be incorporated into memory in a similar fashion (Bransford, Barclay and Franks, 1972; Johnson, Bransford and Solomon, 1973).

Summary

A variety of essentially non-thematic relations among the elements of passages may be described, not all of which are used in the comprehension or representation of information from discourse. Temporal relations in particular appear to be psychologically unimportant. Logical relations have been poorly investigated, and while they may be of some significance, it is doubtful whether they play a major role in discourse structure. Causal relations take many forms, have been widely studied, and are important psychologically, though this has probably been overestimated by the preponderance of narratives among experimental materials. They are frequently confounded or mixed with relations of other types.

Anaphoric relations, and the structures formed by given-new relations, fall into a different category. Although in a sense 'thematic', they operate on a somewhat 'lower' level than other structural relations and are probably responsible for mediating them. Anaphors and given-new relations are best regarded as properties of texts affecting the detailed processes of comprehension: the long-term memory representation seems to be formed *after* their resolution. Such relations will not therefore be a topic of enquiry here.

2.4 CONCLUSIONS

Structural properties of text exist on many different levels of analysis. Thematic relations, for example, can be found as anaphors or as global properties of discours2: the former are primarily a feature of the text itself, the latter are constructions by individuals. For the present investigation of the relationship between text structure and memory representation, thematic and causal properties are the most important. Each brings its own methodological difficulties: thematic relations are not always well defined and can exist on very different levels; causal relations (and episodes based on them) may be confounded with other properties of discourse, and have too often been studied using simplified narrative material in which other relations are almost eliminated.

Research has only begun to tackle the complex interrelations formed by causal (ie episode or goal-oriented) structures, though they have dominated many of the models of text comprehension which are described in the next chapter. It is probable that the interests of these models and the restricted experimental materials used in discourse research have caused the importance of causal relations to be over-emphasised. This is particularly unfortunate because thematic relations, which are also important in text comprehension, can subsume causal ones. For example, a goal may be a topic, and the action sequences constituting the pursuance of a goal will inevitably be thematically related to each other. If thematic relations were the main organising factor, however, less direct or 'weaker' connections would be involved than in a strictly causal account, together with relations that were not causal at all.

CHAPTER THREE

MODELS OF TEXT STRUCTURE

3.1 INTRODUCTION

Passage type

It is an established finding that passages of different structural characteristics are not remembered as well as each other. Specifically, narrative passages are better remembered than other types of discourse, whether description, exposition or argument (eg Bartlett, 1932; Gomulicki, 1956; Thorndyke, 1975a; Hidi, Baird and Hildyard, 1982). Of these, it is descriptive or expository material which is the least well defined. Narrative passages ('stories') are dominated by plot and action sequences, but descriptive passages, may or may not include activites, and there is no clear distinction between 'description' and 'exposition'. Despite this potential for confusion, no definition of these types of material will be attempted because it is structural relations that are the main focus of attention, not gross passages types which are distinguished by content differences too. Naturally occuring passages usually contain many several kinds of structure and content, though it is difficult to avoid confounding these two factors.

The superiority of narrative material has been the subject of considerable research. Narrative passages have even formed the basis of mnemonic strategies (Bower and Clark, 1969; Herrman, Geisler and Atkinson, 1973; Thieman, 1974). Narrative (plot-related) elements of stories are better recall cues than descriptive elements (Neisser and Hupcey, 1975) and narrative passages are read faster than expository (descriptive) passages (Graesser, Hoffman and Clark, 1980).

It is usual to ascribe the superiority of narrative material to its greater degree of structure; for example, Garnham, Oakhill and Johnson-Laird (1982) found that comprehension and memory for descriptive passages was less affected by structural disruption than for narrative passages. They explained this by the lower referential continuity of their descriptive passage, but did not attempt to compare narrative and descriptive passages of equivalent referential continuity. Descriptive material need not lack structure, though its structure may well be of a different kind from that of narrative material:

Dawes (1966) offered a set theoretic description of the structure of prose material that could serve as an example, and Hidi, Baird and Hildyard (1982) discovered that mixed narrative-expository passages were less well recalled than either type alone, possibly because subjects' structural expectations of *both* types of passage had been violated.

Types of model

There are two main types of model or theory which attempt to account for discourse comprehension, usually in the form of 'text'. 'Text' will refer here to any self-contained passage, whether spoken or read. These approaches are:

1. Propositionally-based models, where the main emphasis is on the interrelationships among the constituent concepts and propositions without regard for any higher level structures they may form; eg Kintsch (1974), Meyer (1975), Frederiksen (1975).

2. Schema-based models, where the principal organising factor is at a more global level, though propositions are usually retained as the unit of representation; eg Rumelhart (1975), Schank and Abelson (1977a), Kintsch and Van Dijk (1978).

For the most part, propositionally based models, even when simple hierarchical relations among the propositions are described, prove to be rather limited. They have mostly given way to schema-based models or ones combining both levels of description. For this reason, and because only schema approaches deal with the important high-level structures which are an essential characteristic of discourse, the focus here will be on the latter. An exception will be made of Kintsch's model because of its extensive empirical investigation, its similarity to other network models of memory, and the fact that a more 'schematic' model has been developed from it.

The term 'schema' has no well-defined meaning in memory research. Since Bartlett (1932), it has come to refer to any organised grouping of information in memory which is capable of operating as a *whole* in various mental processes, though more recently schemata have been assumed also to possess internal structure. Nevertheless, considerable terminological confusion still remains. Mandler (1979) has equated 'schema' with 'frame', though this equivalence is not widely held. Several important schema approaches to text memory and comprehension will be examined in detail below, but first Kintsch's propositional model, with its strong text bias, will be considered.

3.2 KINTSCH'S PROPOSITIONAL MODEL

Introduction

The basis of Kintsch's earlier work (Kintsch, 1972, 1974) on text is a network model of the memory representation of prose material. It is built from propositions. According to Kintsch (1974: 5): "propositions represent ideas, and ... language (or imagery) expresses propositions". He contrasted the 'base structure' of prose material, consisting of propositions, with 'text', its surface form in words. Kintsch admitted, but did not explore, the possibility of other levels of representation. In this model, the mental representation of the information derived from a text *is* its base structure. Several different texts may be derived from the same base structure, though Kintsch regarded his base structure as 'deeper' than linguistic deep structure.

The propositional structures of sentences and text are represented as a sequence of expressions, each standing for an individual proposition. Kintsch could, but does not, display them as a graphic network (unlike, say, Anderson and Bower, 1973, or Norman and Rumelhart, 1975). Instead, he relies on a notation in which the relation or predicate of a proposition is followed by a list of its arguments, the whole being enclosed in parentheses. Text structure is described by Kintsch as a hierarchical arrangement of these propositions. Anderson (1976: 49) has criticised Kintsch for not adopting a strict predicate calculus notation, though this is probably not important since the notation is in the first instance a technique for the a *priori* description of meaning, not a genuine theory of mental representation.

Evaluation

Experimental tests of Kintsch's propositional model are not detailed investigations of the model *qua* theory, but are attempts to see how far it may be applied (cf Millers's, 1978, 'theory demonstration'). In particular, they provide only general confirmation for the existence of propositions, on which the theory is based.

Kintsch and Monk (1972) gave subjects alternate versions of short passages, differing in linguistic complexity, but deriving from the same set of underlying propositions. Simpler expression produced faster reading times, but did not affect verification latencies for inferences. This implied that the information was held in memory at a level below the surface structure of the passage (which only affected reading) and was the same for each version. Recognition memory for inferences was further investigated by Kintsch and Keenan (1974). Explicit and implicit inferences were compared in otherwise similar passages: explicit inferences produced shorter latencies and fewer errors than implicit ones, but this difference vanished after a 15 minute delay. The authors attributed this to the loss of surface information, which facilitated recognition. Reading rate has been shown to depend on the number of propositions in a sentence, and on the hierarchical structure among them, as well as on syntactic complexity (Kintsch and Keenan, 1973).

All three of these experiments were taken to confirm the psychological reality of propositions, and of base structure as the level of processing in inference verification; reading, a multilevel task, is affected by both surface and propositional structure. The best that can really be claimed, however, is that there exists a level of representation underlying the surface structure of sentences which has some general properties in common with Kintsch's base structure. Another problem with these experiments is that Kintsch and Monk (1972) and Kintsch and Keenan (1973) probably confounded propositional complexity with lexical and syntactic factors. Other methodological problems with Kintsch's work have been discussed by Anderson who concluded that "a constant problem with all his research derives from the fact that Kintsch is contrasting different types of sentences under different conditions" (1976: 53).

Kintsch's claims about the relationship between text and its base structure can create difficulties. Despite his claim that there is no method by which to unerringly derive a base structure from the surface structure of a given text, McKoon and Keenan (1974) appear to do just this with real-life passages of description and argument. They confirmed that propositions absent in surface structure but present in base structure (eg bridging inferences) could be inferred by subjects, but only if they were deduceable from both general knowledge and the text, *and* if the inference was needed to preserve continuity. Such qualifications seem to seriously weaken the case for a base structure of the kind proposed by Kintsch. Argumentative passages took longer to read, which was explained by their greater semantic complexity though no measure of semantic complexity was attempted.

Conclusions

Kintsch's propositional model of text processing has many problems. Unmodified, it cannot easily cope with global information: Kintsch (1974) dealt with subjects' labelling of passages by simply adding a 'label' to their base structure. Subjects' inferences are coped with in an *ad hoc* manner and little allowance is made for individual interpretations, or the effects of past experience.

3.3 MACROSTRUCTURES

The Kintsch and van Dijk model

The term 'macrostructure' was coined by van Dijk (1972) as a concept of great generality, and later applied to the analysis of discourse processing, social interaction and knowledge organisation (van Dijk, 1980). Its application to text memory research (best described in Kintsch and van Dijk, 1978) constitutes an extension of Kintsch's (1974) earlier work. A macrostucture is described thus by van Dijk and Kintsch (1978: 64):

> "... the notion of *macro-structure*, representing the global organization of the semantic structure of a discourse, makes explicit notions such as theme, plot, idea, or schema, used in earlier psychological work, and ... such macro-structures organize both the production and comprehension, storage and recall of complex verbal structures such as discourses."

'Macrostructure' is contrasted with 'microstructure', the set of structural relations among individual propositions, ie Kintsch's 'base structure'. These structures form two quite distinct levels in memory, ie a macrostructure is not simply an upper level continuation of a hierarchical organisation founded on the propositions of the base structure of a text.

Macrostructures are made up of 'macropropositions', constructed from ordinary propositions according to 'macrorules' (or 'macro-operators') which "both reduce and organize the more detailed information of the microstructure of the text. They describe the same facts but from a more global point of view" (Kintsch and van Dijk, 1978: 366). Kintsch and van Dijk describe in detail a processing model for text based on the repeated application of macrorules within the operational limitations imposed by the capacity of working memory. Familiarity influences processing considerably, easing the instantaneous working memory load and providing a 'frame' to facilitate organisation. Subjects' goals constitute a 'schema' which determines the relevance and 'gist' of a given text, ie these are not uniquely predictable properties.

Macrostructures and text structure

The clearest statements about the use of macrostructures in text comprehension are found in Kintsch (1977) and van Dijk (1977a). The concept of a 'frame', borrowed from Minsky (1975, 1977), is used by van Dijk to refer to a hypothetical memory structure, "a higher order organising principle for various kinds of concepts ... [which defines] units or chunks of concepts which are not essentially, but *typically* related" (1977a: 21). A frame therefore provides us with an organised set of expectations, easing the task of interpretating new material; van Dijk gives an example of how several relevant frames may be called up to guide macrostructure construction when we are confronted with a story.

Kintsch (1977) gives his own account of how a macrostructure analysis might be applied to narrative texts. He accepts as given that stories are formed from episodes and that an episode comprises an exposition, a complication and a resolution (a format credited to van Dijk, 1977b). Kintsch then describes how the analysis of a story might proceed using episodes, in some cases nested, to organise the macrostructures. After discussing various approaches to episode structure, Black and Bower (1979) comment that the Kintsch and van Dijk model describes episodes in the same way that story grammars do, but this is probably an illusion: notions about episodes and their structure are a *defining* feature of story grammars, though they might disagree what constitutes an 'episode', whereas they are not at all essential to the macrostructure model. The macrostructure, 'programmed' by whatever frames might be proposed, is such *a flexible* concept that it could encompass almost any such organisation.

Empirical investigations of macrostructures

Kintsch and van Dijk (1978) carried out a series of tests of their model and suggested certain revisions as a result. The model could be used to generate predictions about the probabilities that different components of a text would appear in subjects' reproductions or summaries, and enabled parameters for the probability of reproduction of micropropositions, macropropositions and 'irrelevant generalisations' to be estimated. Even the predictions from a 'special case' of the model, with various simplifying assumptions, gave quite a good fit against experimental data, and the estimated parameter values seemed reasonable and followed an expected decline over 1- and 3-month retention intervals. When a group of subjects was given only the first paragraph of a text so that they could not derive its purpose, the results of immediate recall confirmed that they had been unable to construct or identify the appropriate macropropositions.

A series of experiments designed to investigate the macrostructure of stories in greater detail was described by Kintsch (1977). He was able to show, using cluster analysis, that a simple paragraph sorting task (for a 13 paragraph story) produced groupings that were consistent with predictions from his model. Given such large amounts of information in so few units, however, and the ambiguity of cluster analysis when it comes to serial ordering, this is even weaker confirmation of his 'theory' than Kintsch admits. Unfortunately, some of his other results are no stronger. Subjects were able to adequately reconstruct a passage when the paragraph order was scrambled, which would have been impossible if the sentences had been scrambled *within* paragraphs instead; this was interpreted as reflecting the robustness of macrostructures, but might simply reflect subjects' ability to utilise dependencies between paragraphs that were originally adjacent. Throughout, Kintsch makes only the most general tests of the most general features of his macrostructure model, and then mostly of points which ar not fundamental to the basic macrostructure idea.

Independent confirmation of certain predictions of the Kintsch and van Dijk model comes from a series of experiments by Vipond (1980). Prose recall was accounted for by factors on both micro- and macro-levels; these were distinguished factor analytically, with the former predominating for less skilled readers as expected. Other studies have succeeded in separating out the two types of process in reading tasks (Graesser, Hoffman and Clark, 1980; Cirilo, 1981). The relative recall of macropropositions and high- and low-level propositions in listening to discourse has been found to agree with the Kintsch and van Dijk model (Cirilo and Foss, 1980; Brunner and Pisoni, 1982). The model is further confirmed by the differences in macrorules apparently used by subjects of high and low ability to paraphrase text (Brown and Day, 1983).

Two final pieces of research may be reported which are consistent with the model's assumptions about working memory. Spilich, Vesonder, Chiesi and Voss (1979) investigated the relative recall of a passage by subjects with good or poor relevant prior knowledge. The 'high knowledge' subjects recalled most; the authors explained their results in terms of differential ability to hold information necessary for comprehension in working memory. And Spilich (1983) has applied the model to memory changes associated with ageing and disease, where working memory deficits are well known.

Summary

Like Kintsch's original model, this new, extended model for text processing is highly formalised. This has the advantage that it makes prediction and simulation relatively easy, but the disadvantage that it incorporates many simplifying and arbitrary features. Again, it is a 'model' rather than a 'theory', subject to continuous *ad hoc* development and capable of being 'fitted' to a range of different circumstances, not excluding contradictory ones. This is especially so when Kintsch begins to apply it to text processing. Despite this 'flexibility', it is a more realistic approach than Kintsch (1974), but has generated a lot of research which merely 'confirms', or can be 'interpreted' within, the framework provided.

Nevertheless, there seems to be widespread, if uncritical, support for the Kintsch and van Dijk (1978) macrostructure model. Their proposals about the possible role of working memory in discourse comprehension are particularly interesting, but discussion of processing models lies outside the scope of this review.

3.4 STORY GRAMMARS

Origins

The present author has suggested elsewhere (Cornish, 1973) that the anthropological approaches to the analysis of folktales and myths (see Maranda, 1972) might prove a fruitful source of ideas for research into discourse processing.

One anthropologist whose ideas have been taken up by psychologists is Propp (eg 1968). By comparing the events in a large sample of Russian 'fairy tales', Propp found that there was a finite set of types of actions, actors and so on (a total of 31 actions and 120 other 'elements'). Most of Propp's tales contained only a minority of these elements, but their *order* was usually preserved. According to Propp his tales consisted of one or more 'moves' (ie episodes) consisting of a sequence of actions from a 'villainy' or a 'lack' to marriage or some other outcome. His tales also contained scene-setting elements. Thus Propp gave a description of folktales which consisted of a setting together with a plot comprising one or more episodes.

Propp presented his fairy tale elements as a catalogue and seemed unaware of the the possibility of formalising them using phrase structure or rewrite rules (after the example of Chomsky, 1957). The first to attempt such a formalisation were Lakoff (1972) and Colby (1973), for Russian and Eskimo material respectively. The psychological implications of their analyses were first recognised by Rumelhart (1975) in connection with summarising stories, and by Thorndyke (1975a), who adapted Rumelhart's ideas to study memory. These sets of rules became 'story grammars'.

The amount of research and controversy generated by story grammars over the past nine years has been enormous (see for example Wilensky, 1983). It is not appropriate to give a full review of the literature here, but an evaluation of their *current* status will be attempted.

Story grammars

Story grammars are descriptions of narrative passages based upon a set of rewrite rules; *in theory*, therefore, they make simultaneous proposals about the comprehension and production of stories, and about the resultant memory representations.

Thorndyke (eg 1975a) simplified Rumelhart's (1975) story grammar, and added a 'frame' component (eg Minsky, 1977; cf van Dijk, 1977a). A frame consists of an organised set of background knowledge used by subjects to comprehend aspects of the stories they are presented with. Frames are also Thorndyke's attempt to describe the memory representation of stories themselves. The frame for a concept contains a number of 'slots' for specific pieces of information about that concept. For example, a 'frame' for a story as a whole, according to Thorndyke (1975a), might contain slots for setting, theme, plot, resolution, as well as default information and relations with other frames. Story constituents each have their own frames.

Thorndyke's story grammar contains 10 rewrite rules of which the following are typical examples:

1. STORY ----> SETTING + THEME + PLOT + RESOLUTION

4. PLOT ----> EPISODE(S)

5. EPISODE ----> SUBGOAL + ATTEMPT(S) + OUTCOME

6. ATTEMPT ----> EVENT(S) or EPISODE

7. OUTCOME ----> EVENT(S) or STATE

By these rules, all story constituents, except 'setting', eventually give rise to either 'events' or 'states'; states and events (and the components of 'setting') are represented in a story by propositions which are normally, but not necessarily, stated explicitly in the surface structure of the story. Unlike Thorndyke, Rumelhart (1975) complemented his 'syntactic' rules (like those above) by corresponding 'semantic' ones which described the actual relationships generated by the rewrite rules, and so presumably the memory representation. For example, events may be said to 'cause' or 'allow' or 'initiate' other events, settings 'allow' episodes, states may be conjoined and internal responses may 'motivate' external ones.

There are several important consequences of story grammar rules:

1. Most of the relations among the constituents of a story, whether individual propositions or higher level units, are *causal* in nature.

2. The overall structure for a story is strongly *hierarchical*.

3. The grammars describe story structure independently of content.

Several other story grammars have been devised, differing mainly in their rewrite rules (eg Gentner, 1976; Mandler and Johnson, 1977; Stein and Glenn, 1979).

Thorndyke's work

Thorndyke (1975a, 1975b, 1976, 1977; see also Bower, 1976) presented the first evidence for story grammars from memory research. His experiments are typical of many of those which followed, which share many of the same criticisms.

In the first experiment in his thesis (Thorndyke, 1975a, 1975b), the quantity of recall was found to decline as the passage structure was progressively disrupted, but the disruptions were very simple: moving the 'theme' to the end, omitting it, or randomising the order of the clauses. It seems certain that *any* theory which does not actually *deny* a role to structure in comprehension and memory would be supported by a decline of this sort.

Thorndyke's third experiment varied story structure and content independently, though on examination these seem to be less independent than he claims. Structural repetition (by presentation of two versions with the same structure) within a session facilitated recall, whereas content repetition did not. This was explained by subjects' 're-using' pre-established structural frames, but if content were the more potent organising factor in memory, the interference effects produced by repeated content might impair recall, as Thorndyke found. Indeed, because 'structure' as a variable actually contains some 'content', his results may simply reflect the differential behaviour of contents based on characters and setting ('content') and activities ('structure').

Thorndyke gives no details for the recall of *individual* propositions from any of his passages, but he did assign them to 'levels' within the hierarchy described by his grammar. A clear relation between proposition level and recall or appearance in summaries was found, but the trend was not always as good as he might have wished, and (contrary to Bower, 1976) was not identical for the two passages. The notion of 'levels' is at best a crude test because alternative theories might be supported equally well by data as general as this (cf Meyer, 1975; Wilensky, 1983).

Some recent studies of story grammars

Empirical tests of story grammars have not been confined to summarising and memory tasks. One approach to story grammars has been to verify the story constituents they define. For instance, reading times across constituent boundaries show a relative slowing for the first sentence of a constituent (Mandler and Goodman, 1982). In a comparison of several story grammars, Micko (1982) asked subjects to partition stories into divisions from originals or from memory. The hierarchical partitionings produced, together with the labels assigned by subjects, were compared with the predictions of 6 different story grammars. Micko concluded that "the predictive values of the story grammars investigated differ neither markedly nor consistently" across the 3 stories used (1982: 40). In fact, the overall predictive values of none of the grammars was particularly good.

The recall of different story constituents does not always vary in accordance with predictions from story grammars, especially if content is properly controlled (Nezworski, Stein and Trabasso, 1982). These authors found that only when recall was scored for factors other than gist did the predicted pattern of results emerge, and concluded that structural factors played a part in the *style* of recall subjects adopted, but were not involved in comprehension. This would certainly rob story grammars of their psychological significance. Nezworski et al. claimed that a knowledge of the goals of the main actors and their causal relationships with other story constituents determined comprehension. The importance of causal relations between 'central' story content like this and other information within stories has been supported by Omanson (1982) who found that such a description paralleled but did not supplant a story grammar analysis.

Passage structure has frequently been altered to examine the consequences for comprehension or memory. In one such study, Pratt, Luszcz, MacKenzie-Keating and Manning (1982) looked at subjects' own judgements about what they knew of a short story they had read. 'Garbling' key elements (setting, theme or resolution) of the story, ie replacing the original wording by pronouns and vague phrasing, reduced both judged knowledge and recall as expected from a story grammar. Again, this confirms the story grammar in only general terms because only gross structural elements have been manipulated.

In a rare study of text *production*, Waters (1980) attempted to extract from the class diaries of a single 8- or 9-year old child the rules by which his daily accounts had been structured. She found that a set of rewrite rules was able to describe the diary entries and revealed how the rules and structures had increased in complexity during the course of the year. As few of these resembled the rules proposed by story grammars, the exercise serves mainly to demonstrate the flexibility of rewrite rules as an *analytic* *technique*. The material studied could scrcely have been more limited too.

Finally, Brewer and Lichtenstein (1981) investigated the 'emotive effect' of stories, a characteristic they argued was essential for stories, but was not present in all narratives. Both affective and structural judgements supported this notion of a story and indicated essential features that were not taken into account by story grammars.

Criticisms of story grammars

This section is an attempt to summarise some of the criticisms arising from the research reviewed above and from several recent critiques of the story grammar approach. As Garnham (1983: 146) has said, "although interest in story grammars is declining, it is important that their failings be documented, so that future theories of text comprehension can avoid similar errors".

The simple narratives that have motivated story grammars are themselves a danger: attractive formalisations of their structure need not have any psychological significance, and no arguments to this effect have really been put forward. Such material is already the product of long social transmission: readily recalled and transmitted information, influenced by various social conventions, has persisted at the expense of other information, leaving a sort of naturally occurring 'mnemonic' form. Basing a theory on such material and then studying subjects' behaviour when presented with texts *of the same type*, as so much research has done, is surely dangerously circular. The possibility that story grammars may only reflect certain communicative or narrative conventions (Nezworski et al. 1982) is interesting because that is what might be expected from the anthropological material on which they were based. Related arguments are that story grammars only apply to limited sets of stories which are quite arbitrary, or which are too simple to have any general utility (Johnson-Laird, 1983; Brown and Yule, 1983).

The memory representation implied by story grammars is unclear; there are two possibilities to choose from, exemplified by Thorndyke's 'frames' and Rumelhart's 'semantic rules' (cf Sanford and Garrod 1981, Wilensky, 1983). Other aspects of these theories are similarly ill-defined, eg the 'terminal categories' of the rewrite rules, ie events, states and so on (Johnson-Laird, 1983).

Many of the experimental techniques used to investigate story grammars do so only in a weak or general fashion. Studying the 'levels' assigned to propositions or looking at the effects of relatively simple disruptions of story structure, while confirmatory, are unlikely to be able to distinguish story grammars from rival theories. Indeed, many of the early studies of story grammars suggest a departure from accepted scientific standards of theory proposal and hypothesis testing. Pratt et al. (1982) criticised story grammars for making imprecise predictions about patterns of recall and Garnham (1983) claims that there is no account yet of how the category (as a story constituent) of a proposition can be determined.

Other structural relations are important, alongside or instead of story grammars: relations with central goals (Bower, 1982) or emotional content and structure (Brewer and Lichtenstein, 1981). Sanford and Garrod (1981) claim that story grammars do not explain how we appear to integrate information into a semantic 'mental model' (see below). Johnson-Laird (1983) has argued that no set of rules can explain how knowledge of what is conventional or typical may be used to interpret stories. Another structural feature not covered by story grammars is referential continuity: as Brown and Yule (1983: 120) put it: "the analyst may also be a little worried that the 'story grammar', as formulated, could generate a 'story' which is composed of the beginning of Cinderella, the middle of Little Red Riding Hood and the end of Snow White"; this is probably a little unfair, as typical sentence grammars can produce grammatical sentences which are semantic nonsense without being compromised.

One of the most fundamental criticisms of recent years has been the claim that a story grammar is not even a grammar, in the linguistic sense (Garnham, 1983; Johnson-Laird, 1983; Wilensky, 1983). Stories can easily produce exceptions to any set of rules, whereas natural language does not. We have intuitive notions about the grammaticality of sentences, but not about stories: according to Wilensky, disrupting the sequence of events contravenes our expectations about *content*, but not about *structure*. Further, there are inherent difficulties in constructing a story parser (analogous to a sentence parser) because, unlike the elements of natural language, the propositions of story grammars do not form a finite set - there is no equivalent to the 'mental lexicon'. Story grammars are therefore at best an approximation to phenomena that resist complete formal description.

Summary

The main problems with story grammars have been their inability to develop by prediction and empirical testing: predictions have often been vague, and evidence either weak or disconfirmatory. In addition, they have been unable to describe mental representations of story information with any clarity and their status as 'grammars' of any sort has been seriously questioned.

Some good has come out of this research, however: the importance of causal and thematic relations (Chapter 2) has been emphasised, and some recent 'schema' theories may be seen as reactions against the defects of story grammars. Of these, several script-based approaches, Johnson-Laird's 'mental models' and Wilensky's 'story points' are described below.

3.5 OTHER SCHEMA APPROACHES

Introduction

Macrostructures and story grammars are not the only theories of text comprehension stressing high level organisation and schemata. The approaches outlined below stem either from an acknowledgement of the limitations of network models or story grammars, or have arisen independently under the influence of ideas such as Minsky's 'frames'. While it probably *is* the case that people possess 'canonical' knowledge about discourse (specifically story) structure (cf Mandler and Goodman, 1982), the nature of this knowledge is not well understood, but the sheer *diversity* of current research must be healthy.

Frames

Minsky's concept of a 'frame' (1975, 1977) has already been mentioned in connection with the work of Thorndyke (1975a) and van Dijk (1977a). According to Minsky, frames organise knowledge into structured units containing locations for expected attributes, and function in a range of cognitive activities. Frames may be hierarchically interrelated and operate on different levels of generality. In memory they determine the organisation of both semantic and episodic knowledge, and provide with a set of expectations and 'default values'. Minsky's (1977) description of frames contains features which limit their utility to psychology, though not to research in artificial intelligence. Frames are essentially *non-empirical* formulations designed to capture familiar aspects of everyday experience in a *formalised* manner, and for Minsky their primary purpose is to aid the *computer simulation* of cognitive processes.

The main problem with frames is that they are so 'flexible' that most ordinary situations can apparently be 'explained' in terms of them. This arises from inadequate specification (cf Bartlett's, 1932, schema theory), a defect sometimes shared by macrostructures and story grammars. The notion of a frame cannot guide empirical research unless it is defined more rigorously, and used to generate falsifiable predictions about issues of theoretical importance.

For discourse, Minsky (1977) has tentatively proposed four types of frame; "in order of scale" these are 'syntactic', 'semantic', 'thematic' and 'narrative'. This implies that there are distinct levels of analysis in discourse, that knowlege and expectations are used to comprehend it, and that this knowledge is contained in interrelated 'schemata'. Left at this, not a lot has been said, because there are no constraints on the internal structure of frames. Frames have rarely been directly employed to study discourse comprehension. Workers such as Thorndyke (1975a) and van Dijk (1977) have imported them to describe memory structures in their own theories, but their main influence has come through the derivative notion of 'scripts'.

Scripts

Schank and Abelson (1975, 1977a, 1977b) proposed a "specialisation of the frame idea" which they called a 'script': "a script ... is a structure that describes an appropriate *sequence* of events in a particular context ... a predetermined, stereotyped *sequence* of actions that define a well-known situation" (1977b: 421-422, my italics). According to Schank and Abelson, scripts are part of our *general knowledge* (ie semantic memory). Although the memory representation of discourse cannot properly constitute a script, its encoding and structure may nevertheless be influenced by scripts, and like frames, scripts are involved in generating expectations and making inferences.

The idea of a script is developed fully in Schank and Abelson (1977a), but, like frames, at an almost exclusively 'theoretical' level, appealing to commonsense judgements. Discourse comprehension is treated in detail only for *computer* story understanding. Fortunately, scripts successfully stimulated research of a more empirical nature, much of it reviewed by Abelson (1981), and this enabled Schank (1982: 3) to conclude that "some of the representations we proposed [Schank and Abelson, 1977a] have psychological validity". By this time, however, Schank's definition of a script had changed somewhat: they were smaller or more easily 'decomposed', large scripts having to be constructed when needed, and scripts became "active processors as well as the organisers of memory" (1981: 143), a feature that Bartlett's schemata had possessed in 1932.

Evidence for scripts

One of the most noteworthy studies of the role of scripts in memory is by Bower, Black and Turner (1979). Having elicited typical scripts from subjects, which were in good agreement with each other about the inclusion and sequencing of items, stories constructed around the scripts were given to subjects for subdivision, again showing good agreement. This supported the idea that scripts are hierarchically as well as sequentially organised. In free recall, subjects tended to restore 'missing' activities from stories based upon scripts, and the 'canonical' sequencing of items within scripts appeared to hinder the recall of lists of items which had been derived from scripts but then reordered contrary to the script.

Bower et al.'s final experiment investigated the recall of script-based stories which, like most real-life material, had a number of 'interruptions' written into them (after Schank and Abelson's, 1977a, 'obstacles', 'errors' and 'distractions'). The authors argued that "script recital violates a conversational postulate that enjoins speakers and writers to be informative and not overly redundant" (1979: 209). Typically, it is the 'interruptions', not the scripted activities, that are the *purpose* for telling a story, and they should, therefore, be better recalled than other material; this is exactly what Bower et al. found. They also put forward a theory relating the memory representation of a story to the relevant script, which they called the 'partial copy' model. This states that what is stored in memory of a story is a 'instantiated' copy of the script, ie with the (generic) script items replaced by what actually occurred in the story, except that script items omitted from the story are not copied to the story representation, but merely left activated in the script representation. This explained certain interference and facilitation effects between different stories related to the same underlying script.

Sequentiality is an important property of scripts, but has not been supported empirically. Length of narrative does not affect subjects' verification latencies to script-related events (Guenther, 1980), suggesting that memory search is confined to the relevant 'slot'. Similarly, Galambos and Rips (1982) could find little evidence for sequentiality in scripts, and argued that sequential ordering was constructed as necessary, the 'centrality' of items being just as important (cf Omanson, 1982; see also Graesser's work, below).

Mandler and Murphy (1983) took scripts from Bower et al. (1979) and varied their length and manner of presentation (as stories or sets of phrases). This produced large differences in the way subjects subdivided the script, which Mandler and Murphy took to discredit the technique of subjective judgement rather than scripts themselves. This reinforces Bower et al.'s concern that scripts must contain a lot of information we are unable or do not think to report consciously.

Graesser's work

Graesser has proposed his own version of a script-based model for prose comprehension which he has called the 'script [or schema] pointer + tag hypothesis' (Graesser, Gordon, and Sawyer, 1979; Graesser, 1981). This is taken from Schank and Abelson's (1977) attempt to produce a story understanding computer program. The hypothesis states that the memory representation of a story consists of a 'script pointer' to the most applicable script in memory, together with "'tagged' actions that are unrelated or inconsistent with the content of the script" (Graesser et al. 1979: 320). Graesser likens this to Woodworth and Schlosberg's (1954) 'schema with correction' hypothesis, but a better antecedent is Oldfield (1954).

Graesser et al. confirmed this hypothesis by demonstrating that recognition accuracy for activities within a story was inversely related to their typicality as defined by the underlying script. This is in partial disagreement with one of Bower, Black and Turner's (1979) experiments, in which 'interruptions' were recalled best, but where 'irrelevant' (though still script-unrelated) actions were recalled least well of all. Smith and Graesser (1981) compared the script pointer + tag theory with the Bower 'partial copy' model where typical as well as atypical activities are encoded into a story's memory representation: Graesser's model proved to be superior on a number of recall and recognition tasks. Graesser (1981) discusses his theory further, and demonstrates its power to explain data from a variety of other experiments.

Goals and plans

Schank and Abelson (1977a) define plans as representations for infrequent or novel events that we can understand because we have "access to the mechanisms that underlie scripts" (p.70). These mechanisms enable us to construct 'plans', and plans can be used to represent how 'goals' may be achieved. Schank and Abelson develop the ideas of plans and goals much as they developed the idea of scripts. Although goals and plans have been subject to much scrutiny within an artificial intelligence framework (eg Bruce and Newman, 1978; Wilensky, 1978), there has been little psychological research devoted to them.

Bower, Black and Turner (1979) distinguished between their relevant and irrelevant 'distractions', being better and less well recalled than ordinary script-related activities respectively, as *goal*- relevant and irrelevant, though goals did not feature prominently in their discussion. More recently, however, Bower (1982) has examined the role of both plans and goals in the comprehension of short narratives. Comprehension took longer when the distance between action and goal in a 'goal hierarchy' was greater; action comprehension was slowest when several goals were being followed for the same story character. 'Goal structures' have been discussed in the context of mental models (Garnham, 1983). Lichtenstein and Brewer (1980) concluded that plans, ie the organisation of actions to achieve goals, as well as goals themselves, were essential for understanding how individuals utilise general knowledge to understand and remember both discourse and directly observed events. Plan structures have also been used to explain how subjects were able to restore items omitted from stories (Kemper, 1982).

While there is as yet no well-defined theory of goals and plans to interpret discourse memory experiments, several recent studies are approaching the problem in an *ad hoc* manner. Certainly it seems that goals and their achievement form an important aspect of story content in discourse comprehension.

Mental models

Johnson-Laird (1970) argued against the idea that linguistic deep structure in Chomsky's (1965) sense was represented in (long-term) memory, however good memory might be for meaning (cf Johnson-Laird and Stevenson, 1970, and Greene, 1972). Instead he speculated that in listening to discourse one "sets up a much abbreviated and not especially linguistic model of the narrative" and that "a good writer or raconteur perhaps has the power to initiate a process very similar to the one that occurs when we are actually perceiving ... events" (Johnson-Laird, 1970: 270). Several years later, Johnson-Laird began to develop this idea (Johnson-Laird, 1980, 1981a, 1981b, 1981c, 1983). A 'mental model' became a mental representation of a person, object or event that "mirrors the relevant aspects of the corresponding state of affairs in the world" (Johnson-Laird, 1981a: 174). One of its distinguishing features is that it allows us to make inferences and predictions.

According to Garnham (1983), the mental model we derive from a text is constructed by analogy with past experience (requiring plausibility) and can only be done if we can integrate information across the passage (referential continuity). The importance of referential continuity has been widely demonstrated (eg Garnham, Oakhill and Johnson-Laird, 1982; see also Chapter 2). The effect of plausibility, the subjective estimate of the liklihood of the events depicted in a passage, has also been shown: Garnham et al. (1982) found that stories with reordered sentences but restored referential continuity were still less well remembered than originals, attributing this to subjects' inability to use past experience to understand them, ie they were implausible. Further evidence on plausibility comes from a demonstration by Garnham (1981) that the confusability of two sentences cannot be explained wholly in terms of their semantic similarity, but depends also on "the judged similarity of the range of situations that the sentences would be likely to describe" (p.563).

In a study of the differential memorability of determinate and indeterminate descriptions of spatial layouts, Mani and Johnson-Laird (1982) showed that encoding can take place on at least two levels: 'propositional', giving good verbatim recall but poor recall of gist, and a 'mental model' representation showing the reverse. The latter possessed many of the qualities of a spatial representation. This conclusion was supported by Ehrlich and Johnson-Laird (1982), using two types of spatial description: 'referentially continuous' (adjacent sentences sharing a referent) and 'referentially discontinuous' (no such shared referent). With referential continuity, information appeared to be integrated into a semantic whole reflecting spatial properties of the layout, whereas without this continuity only propositional representations of the sentences were stored in memory. Further evidence for two levels of semantic representation comes from a study by Guenther (1980) in which narratives told by sentences and by pictures gave rise to a 'conceptual' representations.

The mental models research has similarities with work motivated by Bransford and Franks' (1971), who found that subjects spontaneously integrated information from different sentences into semantic wholes in memory, while memory for the actual sentences was lost. Inferences could not be distinguished from original information, even when knowledge external to the sentences was required (Johnson, Bransford and Solomon, 1973). The nature of these wholes and the manner in which sentence-specific information is lost exactly parallels what is claimed for mental models.

Story points

As a reaction against story grammars, Wilensky (1983) has proposed a theory of 'story points'. Story points, he explains, are an attempt to define 'story schemata':

> "Points are structures that define those things that a story can be about ... They characterise those contents that constitute reasonable stories and account for the existence of that story [*sic*] as an item to be communicated ... the content that bears this interest value is what I term the point ... the main goal of the story reader is to determine the points of a story and to structure what is remembered in terms of its points." (p.583)

Wilensky illustrates the distinction between stories with and without points. Points, he claims, are the most accessible parts of a story's memory representation, and the reader of a story attempts to locate points, and uses them to make predictions and organise the other information.

Wilensky goes on to develop a theory of points in some detail, but from an artificial intelligence perspective. He does describe one experiment, however: an unpublished investigation of Kintsch and van Dijk's (1978) 'levels' effect, by Knecht. The constituent propositions of a passage were assigned to levels according to Kintsch's scheme and were further classified as 'pointful' or not by the experimenter's 'intuitions'. Knecht found that 'point membership' could explain the levels effect completely.

Perhaps unavoidably, the points approach has similarities with other ideas in the area of discourse cmprehension. The open peer commentary folowing Wilensky's paper gives a mixed reaction to the idea, though Wilensky admits that his theory needs expansion.

Summary

The evidence suggests that scripts are a potentially fruitful idea in memory research, provided they are not formalised too hastily. Some modification is necessary to emphasise centrality (typicality) in addition to sequentiality, and this would strengthen the analogy with work on 'semantic distance' in the representation of concepts in semantic memory (eg Rips, Shoben and Smith, 1973). It is probably best to regard scripts as components of semantic memory complementary to concepts (cf Bower, Black and Turner, 1979). One problem for scripts is their role in the episodic representation of individual prose passages, though experiments by Bower et al. and Graesser (eg 1981) have begun to provide some answers. A related problem is the role of prominent features in memory and comprehension (Bower et al.'s 'interruptions', Wilensky's 'story points').

Johnson-Laird's 'mental models' approach makes some direct if imprecise statements about the memory representation formed from text. Mental models *qua* memory structures have not really been demonstrated, except for simple scenes and their descriptions. The theory does emphasise the importance of theme or topic in comprehension, which might also be said to be the basis of Wilensky's 'story points', and the integration of information in memory. Neither approach seems fundamentally incompatible with scripts, given that our conception of scripts is likely to develop and change.

The analysis of memory and text in terms of goals and plans, however defined, makes two contributions. Firstly, by the way they organise actions and events in discourse, they may help us to describe better the structure of memory representations. Secondly, they might provide a method of identifying the main components of topic or theme in stories, and how these are used in the process of comprehension.

Some 'schema' research has made no reference to any particular theoretical framework. For example, Yekovich and Thorndyke (1981) found that 'narrative schemata' determine both the (hierarchical) organisation of the memory representation of a story, and the top-down manner of recall. Other studies confirm that some sort of 'story schema' might exist (Thorndyke and Hayes-Roth, 1979; Pratt, Luszcz, MacKenzie-Keating and Manning, 1982), or support schemata in memory for visual scenes (Brewer and Treyens, 1981; Salmaso, Baroni, Job and Peron, 1983). It is difficult to claim, however, that a full-size story schema is supported by the data, rather than less ambitious organisations of information dependent on certain types of story content, albeit with a bias towards activities and their interrelations.

3.6 CONCLUSIONS

Issues

There are a number of fundamental issues concerning the organisation and representation of discourse which are central to the various structural models, but which they leave unresolved:

1. One of the central issues is the conflict over whether the episodic memory representation is organised by structures inherent in or peculiar to text, or by our general knowledge of what is depicted.

2. A second problem is the relative importance or functions of two possible levels of encoding: 'propositions' and something deeper, constructed from, but not consisting of, propositions (cf Manelis, 1980).

3. The relative roles of sequential and hierarchical organisation have also been the subject of disagreement (cf Galambos and Rips, 1982).

4. The importance of certain action-related aspects of structure and content (eg episodes or goals) has been repeatedly demonstrated (eg Haberlandt, Berian and Sandson, 1980; Bower, 1982). But the crucial question is whether they show the general importance of causal features, or are an artefact produced by the intensive use of clear, simple narratives as experimental materials.

It is curious that few if any of the central issues concerning the organisation of memory for discourse seem near any kind of solution. One impression from this chapter is that both theory and experiment are to blame: the former for being prematurely elaborate and too concerned with neatly formalised expression, the latter for a tradition of weak empirical tests and artificially constrained materials. The next chapter will take up some of the central problems for investigation.

Methodology

Finally, of the many methodological problems raised by the text models, the following are particularly worth highlighting:

1. It has already been frequently noted that many experimental materials have been so artificial that either they impose unnecessary constraints on subjects' behaviour, in a direction predicted from theory, or make generalisation hazardous. Unfortunately, the constraints of systematic

hypothesis testing probably allow little scope for improvement.

2. Repeatedly, it is has been seen that many tests of these models have been too superficial, confirmation has been obtained would might support several alternative theories equally well; for example, there is a 'levels effect' predicted (and found) by almost any model with hierarchical features: eg Meyer (1975), Thorndyke (1975a), Kintsch and van Dijk (1978), Wilensky (1983).

3. One feature of several models is their preoccupation with elaborate formal development while even their most basic assumptions are still subject to considerable empirical controversy. Such development may be justifiable in artificial intelligence research, with which most of the theories have strong connections, but in psychology it can be counterproductive.

In the experiments which follow, an attempt will be made to avoid the repetition of as many of these problems as possible.

CHAPTER FOUR

THE REPRESENTATION OF STORY-LIKE MATERIAL

4.1 INTRODUCTION

Overview

The preceding three chapters arrive at certain conclusions about the nature of the memory representation underlying discourse (specifically text) comprehension, and point out two key areas that require investigation: the nature of the encoding at the most detailed ('propositional') level of representation, and the type of structural relations formed among items in memory. Chapter 3 indicated that extended theorising about the processes or structures underlying discourse comprehension is premature and may well be counterproductive until we know more about certain crucial features of the memory representation itself.

The nature of propositions

The nature of the encoding in the memory representation is the starting point for most theorising on text comprehension. The 'proposition', beloved of investigators in various definitions, is essentially an a *priori* and *analytic* entity, in the sense that it has usually been described prior to experimentation, not from the data obtained. It has been adequately demonstrated that there does exist a level of representation which *approximates* to the propositional, but the clearest evidence comes from highly constrained work with sentences. Its distinctiveness, particularly from more global levels, has still to be demonstrated with extended discourse, and depite behaving as all or none units, as some research suggests, the internal structure of 'propositions' (concepts or semantic features for example) still needs to be properly described. What can be assumed here is a 'propositional' level of representation, being the most detailed level of semantic coding in memory.

Understanding memory for verbatim information derived from text is central in trying to understand the nature of propositions. Long-term verbatim retention has been proposed by some psychologists, apparently in addition to propositions, but the arguments are unconvincing and the relationship between the two types of encoding in recall has been left unspecified. If verbatim recall, defined as whatever parts of a text a subject recalls in the original words, is just an accurate reconstruction from propositional information (the 'accuracy hypothesis'), studying such recall should tell us something about the detail within propositions and about how this detail might be forgotten. An independent verbatim representation (the 'parallel hypothesis') seems unsupported by the evidence, though there has been little satisfactory evidence against it. Distinguishing these two possibilities would be a first step in elucidating the nature of propositions.

Structural relations in memory

The review of models for text structure and processing presented in Chapter 3 indicated several issues which distinguished the different theoretical approaches. The most fundamental of these is whether the organisation of information retained from text is determined by structures inherent in or peculiar to passages themselves, or by the structure of the preexisting knowledge used in their interpretation. I shall call those two positions 'text-led' and 'knowledge-led' respectively.

The most notable exponents of the text-led position are the story grammar tradition and some of the research with scripts and macrostructures that has followed story grammars in adopting an 'episodes' framework. As has been seen, this work has failed to gather *detailed* empirical support and has either been unable to generalise beyond simple narratives, or has done so by becoming an analytic technique of little predictive utility (eg Waters, 1980). Any peculiarly text-oriented structures observed may be due to restricted experimental materials or to the conventions of narrative communication (Nezworski, Stein and Trabasso, 1982).

The knowledge-led view is favoured here, largely because of the lack of success of text-led theorising. It is more recent and has not yet been extensively developed in relation to discourse comprehension; its chief representatives in the literature are mental models, story points, and some applications of the script idea. In general, knowledge-led theories claim that the organisation of text-derived information is largely determined by past experience and constructions from that experience, and that discourse processing is governed by the identification of key topics or themes in the text by the reader or listener, not by the application of essentially abstract 'text structures'.

Chapter 2 suggested that both causal and thematic relations were important in discourse processing. Knowledge-led and text-led theories make different predictions about the structural relations which are important in memory and comprehension. Text-led theories, for example story grammars, base their structures on what I have called 'causal' relations. These include simple cause-effect sequences consisting of goal and action, state and intention, action and outcome, outcome and further consequence (such as a reward); in all cases, given the context, the second may be said to have been caused by the first. 'Episode' or 'goal' structures are really just compounds of certain types of causal relations, and lend themselves to the formation of strongly hierarchical 'superstructures', at least theoretically. Text-led approaches may be said to consist almost entirely of such relations, except for scene-setting information, which tends to be a necessary but *ad hoc* addition to any model.

Knowledge-led approaches to text comprehension do not exclude causal relations. However, they stress the importance of topic and theme, and would predict that memory organisation is determined by the association of elements according to shared topic or the continuation of a 'theme' (perhaps not always explicitly stated). Larger-scale structure would be determined partly by the relations stated within the passage, but partly by the structures expected from our general knowledge of the topics involved. This gives rise to a problem: causal relations very often represent the continuation of topic organised in part according to expectations from past experience. Knowledge-based processing does not exclude causal relations at all, but it does describe them as only *one aspect* of thematic relations, and would not produce the higher-order causally-based structures that are important to text-led processing. Thus the two types of theory can be empirically distinguished and have immediate implications for the relations expected among items in memory.

Intentions

The two problems in text comprehension identified above can be studied by the same set of experiments. The most notable feature of knowledge-led comprehension is that memory for text should be dominated by thematic relations of all types, not just by causally-based ones. Two principal methods of testing this in the free recall of text will be attempted:

1. By comparing the kind of information preferentially recalled and omitted from passages: the two groups of items should differ mainly on thematic

relatedness.

2. By observing the way in which elements in passages are recalled or omitted *together*: any such associations should be on a basis of thematic relations, not just causal ones.

The most likely difficulty to be encountered in testing these predictions is the confounding effect of text content: most researchers have discovered that descriptive material is considerably less well remembered than narrative material, and it is necessary for realistic experimental materials to contain both types of information.

The other fundamental issue identified in the literature review is the nature of the 'propositions' used to encode information from discourse. There seems to be little about the verbatim component of ordinary prose recall that cannot be explained in terms of reconstruction from a highly accurate 'semantic' representation. Two implications arise from this:

1. The verbatim recall component should not behave differently from other recall in response to experimental manipulations.

2. Detailed comparison of information recalled in the original words with information recalled in other words should show that they differ either in accuracy of recall or in ease of reconstruction.

In addition, it should be possible to come to some conclusions about the distinctiveness of the 'propositional' level of encoding and about the nature of the detail recorded within propositions.

The starting point for the sequence of studies to be described is Experiment I, in which every subject was asked to recall the same 9 passages, to provide a carefully controlled data pool. Analyses of this data are presented in several places, and form the basis for all other investigations. Experiment I enabled observations to be made on the structural relations among passage elements and on the behaviour of the material recalled verbatim. Structural relations, using the 'clause' as unit, are discussed in a qualitative description of the differences between recalled and omitted clauses, in Experiment IV, and in the more complex analyses of Chapter 6. The verbatim recall component is explored here and in the experiments of Chapter 5. The qualitative analyses of Chapter 7 extend both lines of enquiry. *En route*, consideration will also be given to implications for larger-scale organisation and 'on-line' processing. Finally, Chapter 8 will attempt to bring these strands together in a discussion of the structures and processes underlying text comprehension.

Methodological issues

Methodological difficulties abound in discourse processing research, and any study must pay them careful attention. Subjects may adopt untypical or inappropriate processing strategies, such as rote learning. Experimental materials may highlight certain aspects of structure or content so prominently that subjects' comprehension and memory are tightly constrained in the direction that the experimenter expects. Empirical tests, however supportive of a given approach, may fail to distinguish it from equally admissible alternatives, though often this is as much a fault of premature or over-elaborate theorising as of the experimental tests. The solutions attempted by the present research to circumvent these difficulties are described below.

A simple free-recall paradigm was adopted for all experiments because of the ease with which it enables the gathering of relatively 'complete' sets of data from subjects, though given the stylistic and other constraints of the recall situation, it is probably not as 'direct' a method of accessing the memory representation as recognition (cf Voss, Tyler and Bisanz, 1982). In addition, special attention was paid to the selection of appropriate passages, all of which were specially written by the experimenter.

Apart from experimental conditions and materials, the other crucial factor determining the results obtained in discourse memory research is the analyses performed on the data. As the research progressed, several different types of analysis were employed, and these will be explained as they are encountered. Most analyses were based on either the word or the clause as unit, and this decision is explained below.

4.2 MATERIALS

Introduction

The choice of passages for memory experiments is beset by apparently contradictory requirements:

1. Materials should be as naturalistic as possible, yet easily analysed.

2. They should be broad in content to avoid constraining subjects' behaviour unnecessarily, yet sufficiently restricted to enable regular phenomena to be clearly identified.

3. Passage construction should not be heavily constrained by the theoretical position under investigation, yet should provide an opportunity for theoretical positions to be tested against each other.

In addition to balancing these requirements, other factors had to be satisfied in passage construction:

1. At least within the same experiment, it should be possible to compare subjects' recall of different passages with each other, implying a degree of standardisation.

2. Material should be long enough to contain a reasonable amount of complexity and detail, yet not so long as to make administration and analysis difficult.

Inevitably, additional criteria were used in writing passages for particular experiments, according to purpose.

The present research involved a total of 14 passages, comprising:

1. A set of 9 for Experiment I, 3 of which were used unadapted for Experiment II. Many subsequent analyses were based on these passages.

2. Experiment III employed a further 2 passages.

3. For Experiment IV, 2 passages were specially written, each consisting of a set of 3 variants.

4. Finally, Experiment V used a rather different passage, longer than the others; it was a heavily modified version of a story taken from the literature.

The materials from Experiment I were easily the most intensively analysed, and so they will be described fully here. The other texts will be explained in accounts of the studies which use them.

Materials for Experiment I

The 9 passages of Experiment I were written to satisfy as nearly as possible the criteria set out above. All are 'stories' in the sense that they are passages complete in themselves containing a mixture of narrative and descriptive elements, and all might easily have been termed 'stories' by subjects. Unlike some previous research, no strict definition of a 'story' was attempted or thought necessary. All passages were written by the Experimenter, thus maintaining a degree of stylistic uniformity, and all tried to avoid appearing artificial to the reader. The passages are reproduced in Appendix 1.1.

The passages were each 225 words and 30 clauses in length. A 'clause' (see below) was defined as any verb, *whether finite or not*, together with its associated parts of speech. The clauses within each passage were varied in length to avoid an unnatural style, according to the following distribution:

Length in words	3	4	5	6	7	8	9	10	11	12
Number per passage	1	2	3	4	5	5	4	3	2	1

Clauses of different lengths were distributed fairly randomly throughout passages. Each passage averaged 7.5 words per clause, a reasonable figure for prose fiction according to a small study.

To introduce a 'controlled variety' into the set of 9 stories, 3 types of gross structure and 3 types of content were defined, and each passage was intended to approximate to a different structure/content combination. Structural types, numbered 1 to 3, are described later, but the content types were:

1. Mythical in tone or set in primitive cultures (A).

2. Set in familiar everyday, perhaps domestic, circumstances (B).

3. Dealing with mechanical devices (C).

Each Experiment I passage was referred to by one of the 9 number/letter combinations, from 1A to 3C.

Neither structure nor content could constituted an experimental 'factor' because of the great similarities that would have introduced among passages administered to the same subjects. In other words there was no intended repetition of either content or structure. Nevertheless, it was hoped that the differences introduced were systematic enough to enable generalisation across passages of the 'same' structure to be made in the results.

A few minor shortcomings were accidentally introduced during the construction of the passages; though discovered too late for correction, none was thought likely to have significantly influenced the results. The errors were:

1. In passage 2C, the phrase "due to" was counted as a verb, with a clause centred on it.

2. Also in Passage 2C, the word 'curlicues' was misspelt 'curlicules'.

3. Passage 3B contained only 224 words.

Describing story structure

Each story was designed to contain a mixture of thematic and causal relations among its constituent clauses; certain other relations between clauses were also present, some purely temporal, others providing subsidiary description or qualification. These provided an opportunity for the analyses performed on subjects' recall scripts to compare different structural features, and enabled overall structural differences among the passages to be defined. Using whatever relations seemed most appropriate, and therefore in a fairly loose fashion, the Experimenter described for each clause which other clause it appeared to 'follow on' from, that is, which other clause (if any) appeared to be a *logical prerequisite* for the given clause. The relations thus 'introduced' consisted of causal and other thematic relations of various kinds, together with a few based purely on temporal sequencing.

These structural dependencies among clauses enabled three types of gross structure to be introduced into passages during their construction:

1. 'Linear' passages (1), where each clause seemed to follow on from the previous one.

2. 'Branching' passages (2), in which a clear linear sequence was accompanied by a series of 'side-branches'.

3. 'Nodal' passages (3), where a collection of 'branches' shared a common starting point, but lacked any dominant sequence.

Linear structures produced stories that were primarily straight-forward narratives, while nodal passages were mainly descriptive. Branching passages were narratives with subsidiary description and action. The actual structural schemes for each story are given in Figure 4.1.

One consequence of this method of structural description is that, as in many previous studies, 'levels' could be defined among the clauses. Despite the criticisms made of studies of the 'levels effect' in previous reearch (Chapter 3), it was thought that levels might at least provide *general* confirmation of the structural descriptions employed, particularly as they would be only one of several lines of investigation into passage structure. The level of each clause is given in Appendix 1.1, and the number of clauses of each level for each passage are summarised in Table 4.1.

Table 4.1: Experiments I and II: Passages 1A to 3C: numbers of clauses of each level

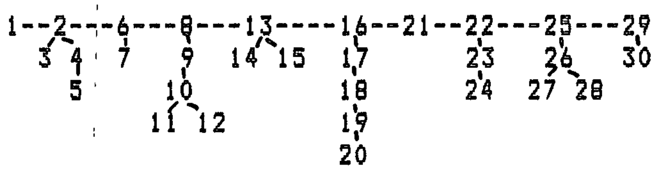
Clause level	number of such clauses: by passage: 1A	1B	1C	2A	2B	2C	3A	3B	3C	by structure: 1	2	3
0	30	30	30	10	10	10	2	2	2	90	30	6
1	0	0	0	10	10	10	7	7	7	0	30	21
2	0	0	0	6	6	6	11	10	11	0	30	21
3	0	0	0	3	4	4	9	7	9	0	18	32
4	0	0	0	1	0	0	1	4	1	0	1	6

Figure 4.1: Passages 1A to 3C: a *priori* structural schemes

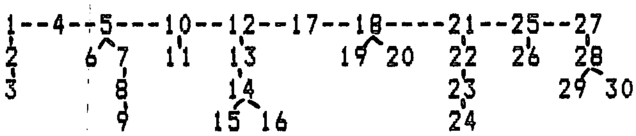
Passages 1A, 1B, 1C:

1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30

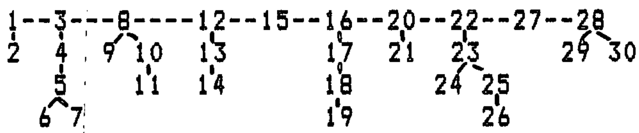
Passage 2A:



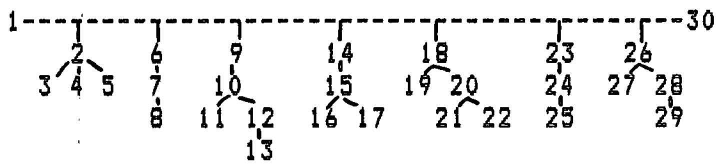
Passage 2B:



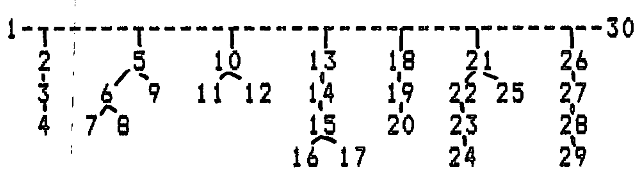
Passage 2C:



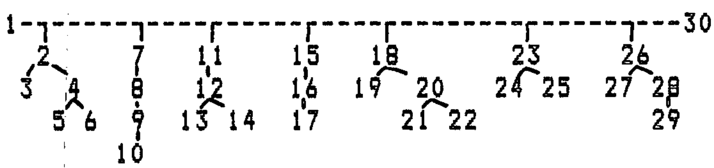
Passage 3A:



Passage 3B:



Passage 3C:



4.3 ANALYSES

Clause-based analyses

Historically, subdividing discourse into units for convenient analysis in memory research has caused considerable problems (eg Levitt, 1956). The unit most usually chosen in recent work has been the 'proposition'. Although primarily an analytic unit, the proposition is frequently taken to have a psychological status too, despite differences among the definitions offered and the limitations of supporting empirical evidence. As defined in Chapter 1, the proposition is a fairly small unit and is therefore not always convenient as a text component.

Several psychologists have accepted larger units than usual, more like clauses (eg Thorndyke, 1975a: 35; Graesser, 1981: 116; Mayer and Cook, 1981; Franks, Plybon and Auble, 1982; Omanson, 1982), because these more adequately reflect complete ideas or statements of the kind that a story might be trying to communicate. Each clause, though it may contain one or several propositions, normally represents a single piece of action or description, and this makes it ideal for analysing the structure of passages, unless they are very short. For present purposes, a clause will be defined as any verb, *whether finite or not*, together with its associated parts of speech, chiefly auxiliaries, qualifying and noun phrases. Thus, for every verb phrase within a passage, a clause exists. This definition creates few problems.

There are two uses for clauses in the present analyses:

1. As a subunit of original material, in terms of which to observe and describe whatever subjects manage to recall, both qualitatively and quantitatively.

2. As the basic components in passage structure between which structural relations will be defined; the overall structure of a passage may also be described by the larger scale organisations formed by clauses.

The role of clauses in passage structure has already been discussed in Section 4.2.

Central to clause-based analyses is the criterion for judging whether a clause is recalled or not. After acertain amount of experience in clause analysis, it was decided to count a clause (of an original passage, not a subject's reproduction) as having been recalled if any *part of it*, other than particles or auxiliary verbs, was identifiably reproduced, *however altered* (mainly by substitution and alteration of context). In borederline cases, a clause was said to recalled rather than omitted.

Word-based analyses

The word can be a very useful unit in studying discourse comprehension, though its small size can make extensive word-based analyses extremely tedious and time-consuming. Its advantages may be summarised as follows:

1. It creates no special problems of definition.

2. It facilitates analysis on as 'fine' a level as is ever likely to be required.

3. It is the natural unit of analysis for studying verbatim recall.

There are two sorts of word-based analyses in the present study:

1. The words of a subject's script may be used, classified into one of three categories according to whether they represent verbatim recall, other recall, or intrusions.

2. Alternatively, as with clauses, the words of the original passage will be compared with what a subject has reproduced to judge if each word can be identified as having been recalled, regardless of whatever substitution may have taken place.

The second type of analysis will be discussed when it is introduced, but the first is best explained here.

The main purpose behind the word-based analyses is the observation of the nature and behaviour of the verbatim recall component, because of its possible role in the memory encoding of text. Verbatim recall must inevitably be contrasted with recalled material that is not verbatim, and this requires a definition of what I shall call 'nonverbatim' recall. But all reproduced material is not actually 'recalled': intrusions by definition do not represent original information in any way, and so it becomes necessary to distinguish three type of information among the words of subjects' story reproductions:

1. Verbatim recall: the number of words recalled exactly.

2. Nonverbatim recall: information recalled, albeit inaccurately, but not in the original words.

3. Intrusions: material found in a subject's reproduction that does not apparently represent any original information.

For many analyses, each of these 'recall components' will be quantified by simply counting the number of words in a script corresponding to that component. The scores so derived will be referred to as 'V', 'X' and 'I' respectively.

It will sometimes be convenient to refer to the total number of words in a subject's reproduction, the sum of V, X and I, and this will be called 'W'. One use of W will be as a (crude) measure of the overall amount of recalled material, and as such it can be compared with the total number of (original) clauses recalled. Although likely to be more sensitive to detailed information, W is 'contaminated' by intrusions and subject to stylistic differences among subjects (eg long-windedness of expression).

It quickly became apparent that there was much greater scope for subjectivity and extraneous influence in the use of the word-based scores than in scoring for clause recall. Given the importance of verbatim recall in particular, it was decided to conduct a separate study to identify and ameliorate the problems likely to be encountered in the use of word-scores. This is described in Section 4.4.

<u>Structural analyses</u>

Structural relations play an important part in the current investigations. A series of structural analyses of increasing complexity will be employed throughout this Thesis. Each technique will be explained as it is encountered, but an overview here will put them in perspective.

The sequence of structural analyses may be summarised thus:

1. Gross observations on the relative recallability of passages of different overall structure.

2. Quantified results (recall frequencies) on the recall of individual clauses, analysed by factors such as length and serial position.

3. Observations on the relationship between clause recall and clause 'level' within the *a priori* structures defined for each passage.

4. Other observations, chiefly of a qualitative nature, on the differences between clauses most and least frequently recalled, referred wherever possible to structural factors.

5. More detailed attempts at relating clause recall to features of the *a priori* passage structures.

6. Analysis of contingencies among clauses in terms of their recall or omission, related to structural features as well as overall structure.

7. Simple cluster analysis of the recall contingency data, again related to both features and overall structure.

8. Certain structure-related observations in the detailed word- and clause-based qualitative analyses.

4.4 MARKING STUDY

Introduction

The purpose of the marking study was to compare the use of the word-scores by the Experimenter and independent judges, given simple criteria only. This was intended to lead to an estimation of the reliability of the scores, and to a clearer formulation of the scoring criteria, thereby minimising subjectivity in their use. It also became possible to look at the Experimenter's own reliability.

Judges

Three judges (2 male, 1 female) took part in this study, all postgraduate research students in Psychology.

Materials

The set of photocopied materials given to judges consisted of the following:

1. A brief explanation of the study, with instructions and scoring criteria: this is reproduced in Appendix 2.1.

2. A copy of passage 2C as used in Experiment I, together with copies of the recall scripts of 7 subjects. Passage 2C was chosen because it combined narrative and descriptive elements and had been fairly average on most scores. The scripts were selected to represent the full variation of scores produced by subjects, and were all rewritten by the Experimenter in a uniform hand. Labelled boxes were provided for judges' scores.

Procedure

The study took place about 2 years after the initial analysis of the data from Experiment I. Judges were allowed to take away and complete the task in their own time. All marked scripts were returned within 3 weeks, and the total time devoted to it was reported to lie between 1.5 and 3 hours. No difficulties were reported other than tedium.

5 weeks after rewriting the scripts, and 2 years after first marking them, the Experimenter remarked the 7 selected reproductions in the same way as the judges. This took 1h.15min.

Results

The raw scores obtained from judges and the Experimenter's two attempts are presented in Appendix 3.1, and the means and ranges across all 7 scripts are shown in Table 4.2, together with Kendall coefficients of concordance and equivalent Spearman correlations.

Table 4.2: Marking study: means and ranges for word-scores for each judge, across scripts

Score		Judge 1	Judge 2	Judge 3	Experimenter 1	Kendall W *	Equiv. rs	Experimenter 2
W	(mean	162.1	166.6	168.1	167.7	0.987	0.983	167.3
	(range	108	113	114	113			113
V	(mean	57.1	78.1	50.9	91.4	0.963	0.951	94.4
	(range	96	106	111	104			100
X	(mean	97.9	73.4	50.9	56.9	0.668	0.557	55.0
	(range	57	36	37	36			26
I	(mean	7.1	15.0	33.9	19.4	0.825	0.767	17.9
	(range	22	42	44	38			35

It can be seen that inter-judge differences on V, X and I are rather larger than might have been expected. There seems to be a reluctance to score *positively* by some judges (ie as V or I) and this has the effect of increasing the values of X obtained considerably in these cases. Judges probably agree better on the order than on the magnitude of the scores assigned. Kendall coefficients vary between +0.67 and +0.99, quite pleasing, though these probably overestimate the 'real' agreement among judges since scripts were chosen to cover a wide range of scores.

The 2 marking attempts of the Experimenter are very similar indeed, probably because of the great amount of practice he had had by the time of the study. In many ways, the Experimenter's scores represent an upper limit (for V and I) on scoring.

Extensive qualitative examination of judges' scoring was undertaken to establish reasons for the observed discrepancies and to clarify the criteria involved. These gave rise to the recommended scoring criteria of Appendix 2.2. Among the reasons for scoring differences were:

1. A reluctance among judges to score isolated words and phrases as V or I.

2. Alternate ways of coping with contractions, abbreviations, compound words and 'implicit' pronouns.

3. High rates of inconsistency and genuine errors among judges, often looking like haste or carelessness.

Discussion

Overall, the word-scores seem quite reliable, especially if close attention is paid to the recommended criteria. In particular, the Experimenter's own scoring seems to be particularly consistent, and this must reflect well on the results of all experiments employing these scores.

4.5 EXPERIMENT I

Introduction

The main purpose of this first experiment was to systematically gather a large quantity of data which could then be used to investigate the memory represenation of text, in particular the problems of encoding and structural relations.

Knowledge-led processing proposes that memory is dominated by thematic relations and by structures that are strongly influenced by what we already know of the topics in question, not by prior ideas about plot structure. To investigate this, one must begin with passages that have varied content and are not already biased by stark narrative story-lines: this requirement was fulfilled by the construction of the set of 9 stories written for Experiment I (Section 4.3). The nature and number of these passages permits comparisons among them of a holistic kind, as well as providing a wide range of clauses and contexts for the identification of factors, particularly thematic ones, associated with clause recall and omission.

Having described verbatim (and nonverbatim) recall in some detail, it was necessary to incorporate into Experiment I (and ExperimentsII and III) certain factors across which any variations in verbatim and other forms of recall could be observed. The wide but 'controlled' variation in the experimental passages provided one such factor, others being individual differences among subjects and the order of passage administration. If, as seems likely, verbatim recall indicates no more than an accurate propositional representation, the only differences in the behaviour of verbatim and other recall would be associated with factors producing different levels of recall accuracy. In this experiment,these would most obviously be subjects and order of presentation, which be expected to show greater variations in verbatim recall.

Despite the many analyses that will be performed on the present data later, only those concerning the size and behaviour of the 'recall components' will be presented here. Other analyses are given in Sections 4.6 and 4.7, and Chapters 6 and 7.

Subjects

Subjects were 9 male and 9 female undergraduates from a variety of disciplines. All were unpaid volunteers with no prior experience of such an experiment.

Passages

A set of 9 passages was specially constructed for this experiment as described above. The passages are reproduced in Appendix 1.1.

Design

Each subject was given all 9 passages, 3 passages in each of 3 sessions, for immediate recall. The distribution of passages among these 9 trials was subject to a number of criteria:

1. No session for any subject contained more than one passage of each type of structure or content.

2. No subject received more than one passage of each type of structure or content on the same within-session trial in different sessions.

3. Over all subjects, each type of content and each type of structure was followed by each other type an equal number of times.

4. Over all subjects, each passage occurred on each of the 9 possible trials exactly twice.

These considerations produced a Latin square design with repetition, consisting of two Latin squares, unbalanced and somewhat constrained. There were 4 factors in the resulting analyses: subjects, passages, order of presentation and squares. Appendix 2.3 shows the 18 presentation sequences used. Subjects were allocated to presentation sequences at random.

Instructions

It was thought likely that subjects would normally be biased towards literal accuracy of recall at the expense of the recall of content. The instructions attempted therefore to balance the conflicting aims of quantity and accuracy of recall and asked subjects to underline reproduced material whose accuracy they were unsure of, to discourage them from leaving it out altogether. Subjects actually made little use of underlining so this material could not usefully be analysed separately. The instructions used in the Experiment are presented in the Procedure. Complete instructions were given only on the first occasion, after which suitably abridged versions were used.

Procedure

Subjects were tested individually or in pairs in a 'relaxed' environment, a typical student study-bedroom such as they all might be familiar with. The instructions, setting and group size were all intended to minimise any test-like atmosphere. Sessions were spaced several days apart. As soon as subjects were seated comfortably, the preliminary instructions were read aloud to them:

> "This is an experiment to find out how people understand and remember prose passages of various sorts. There will be three sessions of which this is the first; each will follow the same procedure. In each sessin you will read three short passages, making nine altogether. They are all different, but are about the same length; all passages will be given to you on slips of paper, typewritten. After reading each passage, you will be asked to write out as much as you can remember. This will be repeated for each of the three passages in each of the three sessions. Each session will last about 45 minutes. Stop me at any point in a session if you are not sure about something. You will be asked at the end of every session not to mention anything about any of the passages to anybody else who might be taking part, as this could invalidate their results. Are there any questions?"

Subjects were then given the first passage, face down; it was untitled and typewritten on a slip of paper. The instructions for reading were then read out:

> "You have now been given the first passage to read. The passages are very short and are all the same length. You should read each one through *twice*, remember *twice* only, at *your normal reading speed.* I want you to read each just as you would read a passage in a book or a newspaper. I only want you to follow the passage quite normally, to understand it, and, if possible, to enjoy it. I do *not* want you to make any special effort to commit any of it to memory. In particular, I am *not* interested in how accurate your memory is for the *precise wording* of the passage. Any questions? You can start now, and let me know when you finish."

Subjects turned over the slips of paper and read the passages. When finished, they were given pens and A4 sheets of ruled notepaper, and were read the recall instructions:

> "Now, I am going to ask you to write down as much of the passage as you can remember, in prose rather than note form. I am not interested in the exact words used originally, but if you do happen to remember them, so much the better. Take your time over this part of the experiment: there's no need to hurry. If there is anything you remember you are not sure of, *underline* it in your account; there may be quite a bit you can't recall, but don't worry about it. When you have finished, check through what you have written, and make any corrections or additions you want, using footnotes if you like. Spelling doesn't matter, and neither does punctuation. Are there any questions? Don't write your name on the paper, begin when you are ready, and let me know when you finish."

The interval between finishing reading a passage and beginning the written reproduction was usually made to last at least half a minute, often rather longer. While subjects were writing, the Experimenter busied himself at his desk with inconspicuous acivities such as reading, writing and paper-sorting. When they seemed to have completed recall to their satisfaction, subjects were reminded to check through their scripts, which were collected. Each session ended with the reminder:

> "Finally, I would like you not to mention anything about any of the passages to anybody else who might be taking part as this could invalidate their results."

Sessions lasted 45 minutes on average, with extremes of about 30 and 60 minutes. At the end of the last session, those subjects who wished were given a brief account of the nature and purpose of the experiment.

Results

Only observations on the values of the word-scores will be made here, detailed structural and qualitative analyses being covered later. Full raw data on clause recall (number of clauses recalled out of 30) and word-scores is presented in Appendix 3.2. Figures 4.2-4.4 demonstrate the behaviour of the clause recall scores and the four 'word-scores' across subjects, passages and order of administration, the means on which they are based being tabulated in Appendix 4.1. Each of the five variables - clause recall and the four word-scores - was subjected to an analysis of variance, the results of which are summarised in Table 4.3, with full details given in Appendix 4.2.

Table 4.3: Experiment I: summary of anova results on clause recall and word-scores

	F-ratios on			
	Subjects	Passages	Order	
Variable	df = 17,128	df = 8,128	df = 8,128	
Clauses	9.817 ****	4.681 ***	3.443 **	
W	13.68 ****	3.076 **	4.151 ***	**** p << 0.001
V	20.61 ****	4.360 ***	6.583 ***	*** p < 0.001
X	2.459 **	5.774 ***	<1	** p < 0.01
I	1.531	3.093 **	<1	

The important findings with clause recall concern its role in passage structure. For the present it can be noted that the anova on clause recall shows significant differences among subjects and across passages and order of administration. Clause recall tends to follow the pattern set by the word-score measures W in the graphs, and correlates highly with both W and V+X (Table 4.4).

Table 4.4: Experiment I: Spearman rank correlations among 'quantity-of-recall' measures

W			
+0.97	V+X		p << 0.001 in all cases,
+0.82	+0.83	Clauses	2-tailed tests

The most important finding from the word-score analyses is that V is the largest component of W and is by far the biggest contributor to the variance in W. This is obvious from the figures and from the underlying data (Appendix 4.1). The great variability of V both within and between subjects is reflected in the extreme values for the percentages of the original words recalled verbatim: for subject means, 26% and 59%; for passage means, 36% and

and 44%; for trial means, 31% and 45%; and for individual scripts, 10% and 69%.

From the graphs it is clear the most obvious effect is that, whereas V follows the course of W, X and I more or less fluctuate around their own means. The anovas (Table 4.3) show that all factors produce significant effects on V (and so W). Significant effects on X and I were associated with passages and subjects but not order, but the magnitudes of these variations were much smaller than for V. Intercorrelations among the components of W are given in Table 4.5: apart from the expected correlations with W itself, there is little relationship among V, X and I, except that the correlation between X and I just attains significance.

<u>Table 4.5: Experiment I: Spearman rank correlations among W and its components</u>

W			
+0.86 **	V		
+0.55 **	+0.13	X	
+0.26 **	-0.10	+0.19 *	I

*** p <= 0.001) N = 162,

* p <= 0.05) 2-tailed

Despite the relatively small number of subjects, half were male, half female, permitting some comment on sex differences in the results. In fact, differences on all variables were small or zero: two-tailed t-tests, using the sd's on subjects' individual means, gave p > 0.20 (df = 16) for each of the five variables.

<u>Discussion</u>

So far, the main finding from this experiment is that the verbatim recall component, as defined here, is quite sensitive to the 3 factors in the experimental design, whereas nonverbatim and intrusive recall show smaller or zero variations. This pattern of results, while not technically *inconsistent* with either the 'accuracy' or 'parallel' positions about the relation between propositions and verbatim information in memory (Section 4.1) was not wholly predicted from the accuracy hypothesis favoured here.

Although subject and order of presentation differences might easily be accounted for in terms of accuracy of recall, it is surprising that big differences in *accuracy*of recall should be found across *passages*. That passages show the same pattern of results as the other factors might be taken as modest support for the parallel hypothesis, ie that verbatim and other recall are mediated by different structures and processes and are likely to behave differently in situations the accuracy hypothesis would not expect. Alternatively, it has been assumed that subjects interpret the instructions given them consistently, but middle-of-the-road instructions might give subjects greater opportunity for individual variations and differences in their interpretation. A second artefactual explanation is that the consistency of these results is somehow a scoring artefact. Clearly, results from further experimental manipulations are required before these possibilities can be distinguished, and these will be attempted in Chapter 5.

Looking at the pattern of results across passages, it is disappointing that there are not bigger differences between the 3 structural types, though such a global approach would normally be expected to show up very little. The main analyses of structural features, using Experiment I data, begin in the next section.

Figure 4.2: word-score means plotted by subjects

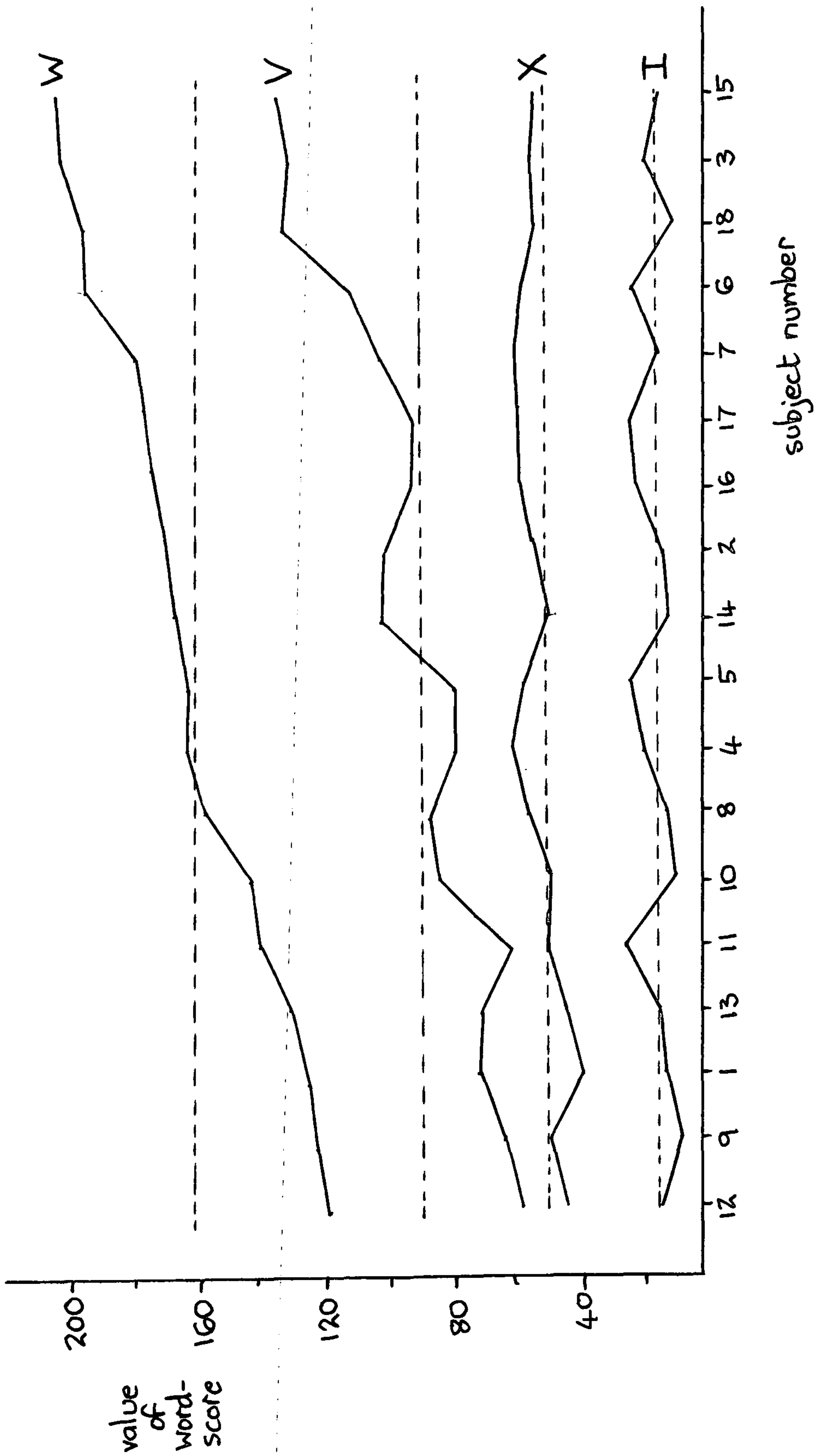


Figure 4.3: word-score means plotted by passages

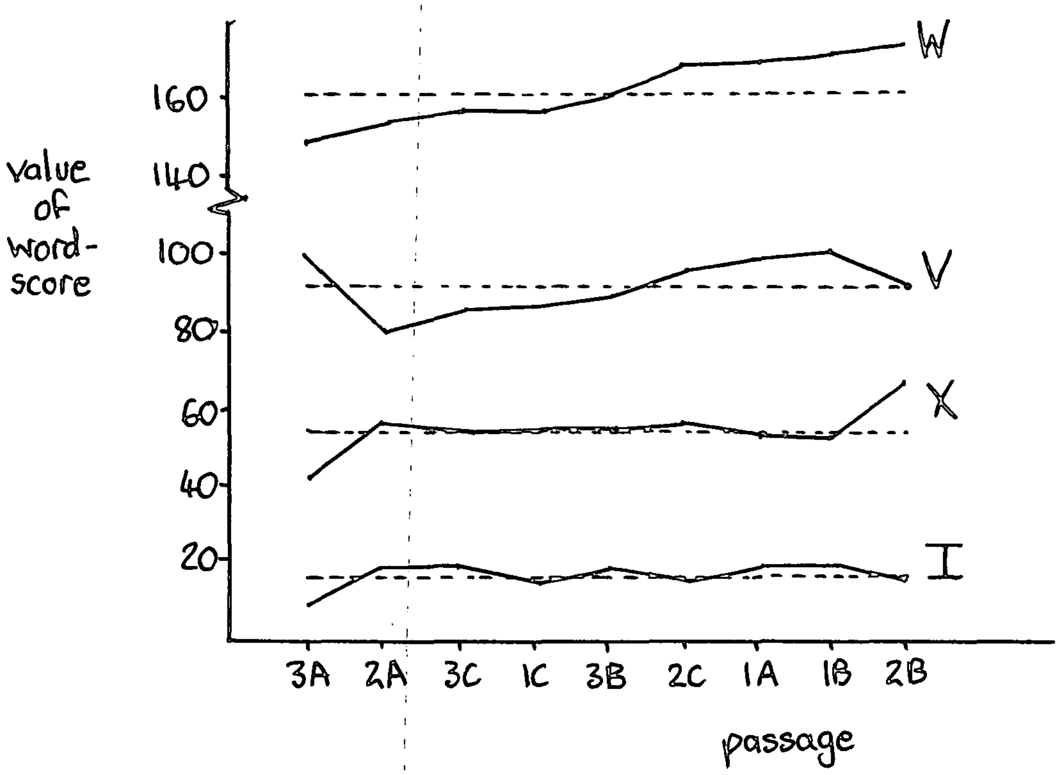
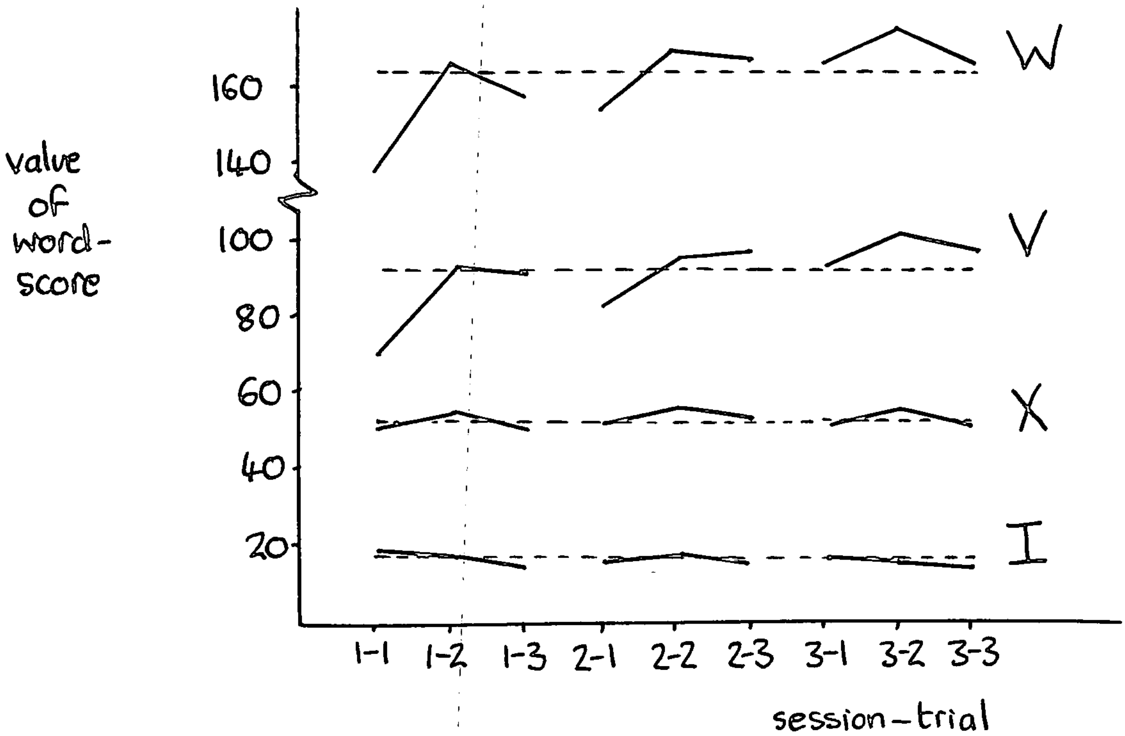


Figure 4.4: word-score means plotted by order of presentation



4.6 PASSAGE STRUCTURE

Introduction

The clause has already been introduced as the basic unit for describing text structure in the present research. This section proposes to look at the relationship between clause recall and certain simple quantifiable features of the stories used in Experiment I. The basic data on which all these analyses are based is the table of omission frequencies for each clause of each passage (Appendix 5.1).

The analyses which follow begin by considering the pattern formed by clause omission frequencies and the influence of clause length on recall. It is hoped that these results will demonstrate that clause recall *is* selective and that the length of clauses, which of necessity varies widely, is not a serious confounding variable in the data. Serial position and clause level (defined by the a *priori* story structures of Section 4.3) are two fairly primitive means of specifying certain structural relations within passages, and their association with clause recall will be described as a preparation for the more detailed structural analyses of Chapter 6. Both begin to show the causes of differential cgause omission, and levels can also indicate very roughly the validity of the causal and thematic relations within the passages.

Omission frequency

Before looking at the structural dependency of clause recall, it is worth confirming that the pattern of clause omissions is non-random. Appendix 5.2 shows the distribution of clause omission frequencies for each passage in Experiment I, together with the numbers expected if clause omissions were simply random, at the same overall recall level. One-sample Kolmogorov-Smirnov tests were performed on the difference between the two distributions for each individual passage as well as for the overall distribution, with the results shown in Table 4.6. For 5 of the 9 passages, the difference was significant, and overall it was highly significant. It can be concluded, therefore, that the pattern of recall omissions for clauses in Experiment I is non-random, ie that considerable selectivity for and against clauses appears to be operating.

Table 4.6: Experiment I: comparison of actual and theoretical frequency distributions of clause omissions

Passage	D *	p	N
1A	0.280	<0.05	)
1B	0.322	<0.01	)
1C	0.169	n.s.	)
2A	0.241	<0.05	)
2B	0.132	n.s.	) 30
2C	0.344	<0.01	)
3A	0.198	n.s.	)
3B	0.186	n.s.	)
3C	0.330	<0.01	)
ALL	0.218	<<0.01	270

* 2-tailed Kolmogorov-Smirnov tests

Clause length

One possible confounding variable in many of the structural analyses might be clause length (ie number of words per clause), relating perhaps to the information content of clauses. Clause length differed widely among the clauses of all passages because of the way they were constructed. It would complicate results if clause length correlated with either clause level or serial position.

Table 4.7 looks at the relationship between clause length and omission frequency for the clauses of Passages 1A - 3C, from which it can be seen that a rough overall relationship does exist between clause length and omissions; this is marginally significant by an extended median test. Correlations were carried out between clause length, and serial position and level, with data pooled across structural types (Table 4.8). In neither case did any correlations approach significance. A check on the relation between clause length and clause level just failed to be significant. It does not look, therefore as if clause length is likely to have been an important confounding variable in any of the structural analyses.

Table 4.7: Experiment I: clause omissions as a function of clause length

Clause length	Number of clauses	1A	1B	1C	2A	2B	2C	3A	3B	3C	ALL *
		Mean omissions per clause									
12	9	0.0	0.0	0.0	1.0	0.0	14.0	0.0	4.0	7.0	2.9
11	18	3.5	2.5	6.5	3.5	4.0	3.0	6.0	4.0	0.5	3.7
10	27	4.3	4.7	0.0	8.3	2.0	0.3	3.7	3.0	6.3	3.6
9	36	0.5	2.5	3.0	1.5	3.5	2.8	5.5	1.5	4.0	2.8
8	45	2.0	2.8	5.0	2.2	3.8	3.2	5.2	2.8	5.6	3.6
7	45	1.6	0.6	4.2	4.8	3.2	2.6	5.0	3.0	4.0	3.2
6	36	3.0	5.8	7.3	5.3	1.5	3.5	6.5	3.0	4.5	4.5
5	27	5.7	6.3	5.7	7.0	2.3	4.3	4.7	8.3	10.3	6.1
4	18	3.5	1.0	13.0	1.5	3.5	1.5	2.0	4.5	5.0	3.9
3	9	4.0	1.0	5.0	5.0	8.0	11.0	5.0	10.0	7.0	6.2
ALL	270	2.70	3.20	4.93	4.13	3.03	3.40	4.83	3.73	5.23	3.90

* Extended median test on original data: $X^2 = 19.13$, $df = 9$, $p < 0.05$

Table 4.8: Experiment I: Kendall rank correlations among clause length, serial position and clause level

Comparison	Passage structure	Kendall tau *	z	2-tailed p
Clause length	(1	-0.0963	-1.344	0.179
&	(2	0.1106	1.544	0.123
Serial position	(3	0.0815	1.138	0.256
Clause length	(2	0.1299	1.813	0.070
& clause level	(3	0.1335	1.863	0.062
Serial position	(2	-0.0826	-1.153	0.249
& clause level	(3	-0.0665	-0.928	0.353

* Corrected for ties

Serial position

All text is sequential in the first instance, and many aspects of prose structure are related in some way to this sequentiality. As a first step in the analysis of passage structure and clause recall, the data of Appendix 5.1 was plotted for each passage and overall to show up this relationship (Figure 4.5). Despite wide fluctuations unrelated to serial position, the first half dozen clauses of most passages seem to be preferentially recalled, as to a lesser extent do the last 2 or 3. There is also the suggestion that it is only structural types 1 and 2 ('linear' and 'branching') which show preferred recall of the final clauses.

Table 4.9 attempts to look at this difference between initial and final clauses, by correlating omission frequency and serial position separately for the first and last 15 clauses of each passage. Data has been averaged *for each serial position* within structural types and overall. The observed relationship with position for early clauses was confirmed for 'linear' and 'nodal' passages and reached an extremely high correlation (+0.971) averaged over all passages. There were no significant correlations, however, for later clauses.

Table 4.9: Experiment I: Spearman rank correlations between serial position and omission frequencies of clauses

Clause no./ Statistics		Passages: Type 1	Type 2	Type 3	ALL	
1 to 15	r_s	+0.854	+0.368	+0.871	+0.971	N = 15,
	t	5.92	1.67	6.39	220.7	df = 13,
	p	<0.001	n.s.	<0.001	<<0.001	2-tailed
16 to 30	r_s	-0.413	-0.336	+0.082	-0.379	N = 15
	t	-1.64	-1.29	0.30	-1.48	df = 13
	p	n.s.	n.s.	n.s.	n.s.	2-tailed

Clause level

Clause 'level' was defined very simply (Section 4.2) in terms of the *a priori* structures around which the passages of Experiment I were constructed. The level of any clause was its distance from what was called the 'main sequence' of clauses in the passage, and in practice varied from 0 to 4. It can be predicted that clauses of 'deeper' levels (say, 2 to 4) would be less well recalled than others for either of two reasons:

1. They are less structurally important, ie more distantly related to the overall structure of the passage.

2. Their meaning, and hence whether they are recalled, is dependent upon higher level clauses; their frequency of recall cannot therefore be greater and would normally be expected to be less than that of the clauses on which they are dependent.

According to Table 4.1 above, all the clauses in type 1 ('linear') passages are level 0, so that no relation between clause recall and level is possible for them. Type 2 passages ('branching') contain mostly higher and type 3 ('nodal') mostly lower clauses, but an association between level and recall might be predicted for both.

Table 4.10: Experiment I: mean omissions per clause as a function of clause level

	By passage									By type		
Level	1A	1B	1C	2A	2B	2C	3A	3B	3C	1	2 *	3 **
0	2.7	3.2	4.9	3.1	1.6	3.2	1.0	0.5	1.0	3.57	2.63	0.83
1				4.3	2.8	3.7	3.0	3.0	3.4		3.60	3.14
2				4.7	4.5	1.2	4.7	3.9	5.0		3.44	4.50
3/4				5.5	4.8	6.5	7.2	4.7	7.6		5.58	6.42
ALL	2.70	3.20	4.93	4.13	3.03	3.40	4.83	3.73	5.23	3.57	3.53	4.62

Extended median tests (* $X^2 = 13.88$, df = 3, $p < 0.01$
on original data: (** $X^2 = 13.50$, df = 3, $P < 0.01$

Table 4.10 summarises the mean omissions per clause at each level for each passage, and averaged over passages of each structural type: level 4 clauses have been grouped with level 3 ones because of their very small numbers. For all 6 relevant passages the highest mean omission frequency is found for level 3 and 4 clauses. Extended median tests on data from passages combined across structural types showed significant effects for both 'branching' and 'nodal' passages. Clause level by this definition dose, therefore, seem to determine recallability. Incidentally, there were no appreciable correlations between clause level and either serial position or clause length (Table 4.8).

Discussion

Clause recall has been investigated here in four simple ways, with some satisfyingly clear results. Firstly, not as trivially as it might first appear, it was established that clause recall is highly selective: some clauses are indeed consistently recalled by subjects, and others are just as consistently omitted. Next, it was shown that although there was *some* relationship between the length of a clause and its omission frequency, this was not as marked as had been feared, and probably had little influence on later analyses.

Serial position inevitably reflects aspects of passage structure, but additionally may be a determinant of clause recall in its own right. The data from the 9 passages of Experiment I failed to suggest more than a minimal association between serial position and recall, except for the first 5 or 6 clauses in a story. This is probably caused by the important information in a story being given, or at least expected, near its beginning, and would be accounted for by almost any theory of discourse comprehension. More surprisingly, there was no significantly enhanced recall for the last few clauses, which might be expected to have a similar status.

Clause level, though a common measure in the literature, can confirm only indirectly the validity of a particular method of structural description. Nevertheless, the method chosen here for defining clause level passed this test with quite a marked association between clause recall and level, the lower levels of clauses being less well recalled as expected. At least the method of describing structural relations by causal and thematic links, adopted in Section 4.2, has some general psychological validity.

4.7 CLAUSE DESCRIPTION

Introduction

This section is an attempt to analyse the differences between those clauses most and least frequently omitted, in a descriptive or 'qualitative' fashion. Further discussion of qualitative analysis is given in Chapter 7, together with more extended analyses. In particular, it was intended to test the prediction that thematic relations are the major determinant of clause recall. Since qualitative analyses are essentially subjective, the scope for bias in these judgements was reckoned to be great, and will be the subject of a further investigation in Section 4.8.

Data selection

There were two immediate problems posed by the data for this study:

1. Presenting the results of such analyses can be extremely lengthy.

2. Many of the findings of these analyses depends on small numbers of clauses, so that restricting the data pool to the results of Experiment I, based on only 18 subjects, might produce conclusions of little reliability.

It was decided, therefore, to present detailed results in an Appendix only, with a summary of essential features here, and to pool the data for the 3 passages used in both Experiments I and II. (Experiment II is described in Chapter 5.) This combined results over several different experimental conditions, but this seemed justified because:

1. There were no *a priori* reasons to expect differences among conditions except in the overall level of recall, ie not in terms of the pattern of clause omissions.

2. Kendall coefficients of concordance across the 4 conditions (Table 4.11) indicated a high degree of agreement on the overall pattern of clause omissions.

3. Most of the analyses compared the top 50% recalled clauses with the bottom 50% for each passage so that fine distinctions among clause omissions were probably unimportant. The 2 experiments agreed well on this division: of the top 50% or so clauses on omission frequency for Experiment I, only 1 clause each for Passages 1A and 3B, and 2 clauses for Passage 2C were *not*

also in the top 50% for the pooled data.

The recall and omission data used in these analyses is summarised for all clauses in Appendix 5.3.

Table 4.11: Experiments I and II: Passages 1A, 2C, 3B: Kendall coefficients of concordance among clause omission frequencies for the 4 separate experimental conditions

Passage	S	Kendall W *	X^2 df = 29	p	Equiv. r_s
1A	28022	0.786	91.23	<0.001	0.715
2C	28537	0.801	92.92	<0.001	0.734
3B	28519	0.796	92.39	<0.001	0.728

Results

It is always difficult trying to avoid the subjective nature of qualitative analysis. The detailed comparisons provided by Appendices 5.3 and 5.4 are attempts to minimise the problem. Appendix 5.4 presents for each passage the 50% most frequently recalled clauses, combined into a 'passage', and the 50% of clauses most often omitted, similarly combined. These 'half-passages' may be read like normal passages, and it is at once apparent that the best recalled half-passages are more coherent and intelligible than the others, even perhaps for Passage 3B whose 'nodal' structure might be thought to make it less susceptible to this sort of disruption.

At this point, while several different ways of describing these differences suggested themselves to the Experimenter, it was thought most profitable to pursue one particular line of enquiry which related clause omission to the overall structural of the passages. *In general,* the half-passages showed what would have been expected from previous research:

1. Recalled material tends to favour items directly relevant to the plot or purpose of the passage, as well as items introducing topics, actors or events.
2. Omitted material favours subsidiary events not directly relevant to the plot, descriptive items, and material that essentially repeats what occurs elsewhere in the passage.

More specifically, two recurrent factors seemed to be associated with higher omission frequencies:

1. Items which repeat information present elsewhere or which could easily be inferred from other information given: these were called 'redundant'.

2. Material not falling into the first category, but which seemed of little importance to the plot or purpose of the passage as a whole: this type was called 'peripheral'.

The omission of either type of item did not seriously affect the overall meaning of the passage. Table 4.12 presents the most omitted clauses of each passage classified by the Experimenter as either 'redundant' ('r') or 'peripheral' ('p'), ambiguous cases being classified as both.

Discussion

Though not spectacular in themselves, the results of this study seemed clear enough to the Experimenter, and the classification arrived at possesses the important feature that it appears to describe individual clauses in relation to the structure or content of the passage *as a whole*, that is, in relation to some *global* topic or theme, rather than smaller scale structural features or aspects of content. This conclusion is highly tentative, however, and requires independent confirmation. Two different follow-up investigations suggest themselves:

1. To confirm the descriptions so far offered by having the clauses rated by independent judges, without knowledge of omission data.

2. To test predictions from this classification of clauses by experimentally manipulating the relationship between clauses and the passage as a whole.

These ideas will be taken up in the clause rating study and Experiment IV respectively.

Table 4.12: Experiments I and II: Passages 1A, 2C, 3B: classification of most omitted clauses

Type	Omissions	No.	Clauses
			Passage 1A
r	7	29	who was so proud
r	8	18	before espying a shadowy depression in the undergrowth
p	9	4	then visited the village shrine
p	10	5	and prayed to his tribe's ancestral spirits.
r	12	21	He ran over
p	15	9	and crept out of the cave into the moonlight.
r	22	13	Ernu ran after it.
r	22	15	He followed the animal's tracks for over half an hour,
r	23	12	Suddenly the shape vanished into the forest.
p/r	24	20	There was a loud roar.
p	25	10	At first he could see nothing except the misty river banks,
p	25	16	until he came out into a swampy clearing.
r	27	14	He plunged into the undergrowth, bow and arrows in hand.
p	32	24	Ernu jumped among the bushes
r	43	17	He looked around for a while
			Passage 2C
r	8	18	alarming me even more,
p/r	9	11	and disappeared into the carpet.
p	10	2	which is always a dismal prospect before breakfast,
p	10	14	or so he let others believe.
p/r	15	19	because there couldn't have been much left inside by then.
p	19	21	where the sunlight glistened on the rust.
r	19	28	and went to have a shave in the bathroom,
r	22	3	I found to my surprise,
p	23	20	But my friend placed the razor on the table,
r	26	6	which alarmed me at first.
r	28	4	on switching on,
r	29	26	which had had such a deleterious effect.
r	33	9	to look inside for anything amiss,
r	36	7	Indeed, I had never heard its like before.
p/r	37	15	He said he didn't like the look of the steel fragments,
			Passage 3B
p	15	11	one wall housed a deep-freeze the size of a small room,
r	16	3	each room represented a different period:
r	17	22	and had positioned it carefully in relation to the terrain,
p	18	18	Heating was provided by large ceiling panels.
p/r	18	24	as a chick snuggles in a hen's nest.
p	20	12	and the floor was supposedly self-cleaning.
p	21	17	and by using blue-tinted concrete.
p	26	19	which were no fire hazard
p/r	26	29	so as to lend an almost subtropical air to the setting.
r	27	13	The builders had taken trouble
p	29	8	which was to win an important industrial award.
p	29	20	due to their low temperature.
p	33	25	The site also provided the maximum protection from the elements.
r	36	28	distributing them in clusters
r	38	7	hidden fom sight,

4.8 CLAUSE RATING STUDY

Introduction

In the previous section, two qualitative features of clauses were implicated in their recall and omission: 'redundancy' and 'peripheralness'. However, these descriptions were subjective and imprecise. This rating study is one attempt to improve on these limitations by having independent judges rate clauses from the passages on a series of scales related to 'redundancy' and 'peripheralness' under conditions as objective as could be arranged.

Judges

Four judges (2 male, 2 female) took part in this study, all unpaid volunteers: all were postgraduate research students, 3 in Psychology, the fourth in Physics.

Materials

Judges were provided with photocopies of the following materials:

1. An introduction to the study with expanded definitions of the 9 7-point scales and labels for each point of each scale. This material is reproduced in Appendix 2.6, and the rating scales are summarised in Table 4.13.

2. A set of 6 sheets containing Passages 1A, 2C and 3B as single paragraphs; each was followed by a *list* of its clauses with their serial numbers, randomly ordered. No other information about the clauses was provided to judges.

3. A set of 9 sheets, each containing 10 sets of the 9 scales, each scale numbered 1 to 7, 'dk' ('don't know') and 'na' ('not applicable'). Judges had to enter passage and clause numbers in spaces provided.

Rating scales

The 9 scales used included 3 related to 'redundancy', 3 to 'peripheralness' and 3 'dummy' scales unrelated to the interests of the present study, but seemingly appropriate to a task such as this. These are listed in Figure 4.13 together with the values assigned to extreme scale points. In terms of these scales, it is readily predicted that clauses previously designated 'redundant' would score lower than the others on any or all of A, B and C, and that 'peripheral' clauses would score higher on D, E and F. No such differences were *expected* for G, H and I.

Table 4.13: Rating study: rating scales used and the values assigned to their end-points

	Scale description	Value of end-points 1	7
redundancy	(A: intrinsic information content	low	high
	(B: repetitiveness	high	low
	(C: inferability from context	high	low
peripheralness	(D: congruity with context	high	low
	(E: essentialness to story-line	high	low
	(F: narrative-descriptive nature	narrative	descriptive
dummy scales	(G: unusualness	high	low
	(H: interestingness	high	low
	(I: difficulty of comprehension	high	low

Procedure

Judges were given the materials to read and complete at their leisure. Completed forms were returned over a period of 2 weeks to 4 months and the amount of time spent on the task averaged about 11 hours, unsurprising given that the task required 270 difficult judgements. The only problems concerned the definitions of the scale points, either being 'numbered the wrong way round' or contradicting the general definitions of scales (when judges were told to attend more to the latter).

Results

All judges avoided the 'don't know' and 'not applicable' responses, but not all made the best possible use of the scales. Interjudge agreements (Kendall coefficients of concordance) for each of the 9 scales across all 90 clauses are summarised in Table 4.14. These were disappointing as 2 of the 'redundancy' scales and one of the 'peripheralness' scales showed no significant agreement among the judges, and of the equivalent mean Spearman rank correlation coefficients, the highest (for 'narrative-descriptive nature') was only +0.368.

Table 4.14: Rating study: interjudge agreement on the use of the rating scales

Scale	Kendall W *	X^2	p (df = 89)	Equivalent mean r_s
A	0.097	34.6	n.s.	-0.204
B	0.508	180.8	<0.001	+0.344
C	0.287	102.0	n.s.	+0.049
D	0.230	82.0	n.s.	-0.027
E	0.373	132.8	<0.01	+0.164
F	0.526	187.3	<0.001	+0.368
G	0.367	130.6	<0.01	+0.156
H	0.353	125.7	<0.01	+0.137
I	0.224	79.5	n.s.	-0.031

Mean scale values across judges for the clauses in each passage, classified as peripheral/redundant/remainder (24, 28 and 44 clauses respectively) and most/least omitted (27 and 63 clauses), are given in Appendix 4.8. Table 4.15 summarises median tests on the original data for the 9 scales, comparing the two classifications of clauses and the passages: the only significant differences are among passages, on D, F and I, disconfirming the initial hypotheses. Table 4.16 shows the overall Spearman correlations among the scales and with clause omissions; with 2 marginal exceptions, however, all the significant correlations involve one or more of the 3 'dummy' scales, G, H and I.

Table 4.15: Rating study: median tests on differences among passages and types of clauses on each of the rating scales

Differences among	Stats	Rating scales A	B	C	D	E	F	G	H	I
Passages,	(X^2	3.65	0.66	1.88	9.98	4.41	21.97	1.90	4.28	7.37
df = 2	(p	ns	ns	ns	<0.01	ns	<0.001	ns	ns	<0.05
'Redundant'/ 'Peripheral'/ other clauses df = 2	(X^2	2.47	0.89	2.44	1.42	1.08	0.67	1.02	1.83	0.06
	(p	ns	ns	ns	ns	ns	ns	ns	ns	ns
Most and least omitted clauses df = 1	(X^2	0.36	0.56	1.44	3.23	3.34	0.06	1.26	0.53	0.74
	(p	ns	ns	ns	ns	ns	ns	ns	ns	ns

Table 4.16: Rating study: Spearman rank correlation coefficients among rating scales and clause omission frequencies (decimal points omitted)

A	00	+06	+09	-10	-13	-11	-14	+05	-03
	B	+24*	-09	-01	+02	+06	-03	+15	-09
		C	+24*	-05	+08	-16	-10	-11	+11
			D	+17	+06	-06	+12	-19	+17
				E	+02	+14	+35***	+11	-01
					F	-11	-11	-09	-07
						G	+63***	+52***	-10
							H	+17	+04
								I	-32**

*** p<0.001) N = 90,
** p<0.01) 2-tailed
* p<0.05) tests

Discussion

The rating study proved disappointing in two respects: for failing to demonstrate the reliability of most of the scales used, and for showing none of the predicted differences either among 'redundant', 'peripheral' clauses and the rest, or even between the most and least frequently omitted clauses.

These failures may be ascribed to any of 4 possibilities:

1. The clause differences described as 'redundancy' and 'peripheralness' have no objective basis.

2. The 90 clauses in the study in fact differ very little on the attributes defined by the scales.

3. Judges failed to interpret or use the scales supplied properly or consistently.

4. The scale descriptions given to judges were poorly written.

Scale F (narrative-descriptive nature) gave moderate and highly significant interjudge agreement, reflecting identification by judges of differences known to have been present in passages because of the way they were constructed. This at least supports the idea that descriptive differences can be confirmed by a study of this sort. At least on this scale, possibilities 2, 3 and 4 seem contradicted, although some judges did make poor use of the full range of scale points. (2) is further contradicted by significant passage differences on 'D' and 'I' ('congruity' and 'difficulty').

While methodological problems may have been a major factor in the negative findings reported here, there is still a strong suggestion that the differences identified among clauses more and less frequently omitted have little objective foundation. There is, however, an alternative method of investigating the same problem, by experimentally altering the relationship between individual clauses and the overall theme of a passage, and this will form the basis of Experiment IV.

4.9 EXPERIMENT IV

Introduction

In a brief qualitative analysis of clause recall data from Experiment I (Section 4.7), it was found that those clauses omitted most frequently could be described as more 'peripheral' or more 'redundant' in the context of the passage as a whole. Unfortunately, these descriptions failed to be confirmed by asking independent judges to rate the clauses from three of the passages, so that an alternative approach to verifying the original descriptions of these clauses became necessary.

Both of the characteristics apparently distinguishing more and less frequently recalled clauses from each other described clauses in relation to the rest of the passage. In particular, a peripheral clause was one that seemed unrelated to the "plot or purpose of the passage as a whole", ie to a particular kind of topic or theme, a higher order 'statement' of what the story was 'about' which need not have been explicit originally. Redundancy, while comparing clauses with the whole passage, was more a reflection of the information added by a clause than of its *structural* links with other passage elements, ie it is less easily interpreted in thematic terms. However important redundancy might be if empirically confirmed, peripheralness is more closely related to the main theoretical interests of this Thesis, and will form the basis of Experiment IV.

The approach adopted here was to vary the peripheralness of a set of clauses by alterations in the rest of the passage in which they were embedded. The story versions so formed contained a common central section and alternative beginnings and endings which permitted the aim or purpose of the passage as a whole to be systematicaly varied. In one version, the central section would be perfectly intelligible in terms of the purpose implied by the beginning and confirmed by the ending. In another version, the same central section was of undefined purpose until the ending was encountered by the reader. And in a third version, neither the beginning nor ending allowed a purpose to be clearly deduced for the central section. It was predicted that the weaker the thematic relationship between the central section and the passage as a whole became, the poorer the central section would be recalled.

This experiment is similar but not identical in purpose to several others in the literature. Studies such as that by Bransford and Johnson (1973) on the facilitatory effect of explanatory pictures and titles on text comprehension and recall, or the perspective change experiments of Anderson and Pichert (1978) and Flammer and Tauber (1982), all varied the relationship between the content of a passage and some external source of information necessary for interpretation. Omanson (1982) comes nearer the present study. He varied the 'centrality' of target clauses within stories, defined by causal and other relations among them, and found that recall was strongly related to centrality. Unfortunately, Omanson used short simple narratives, and remained very much within a story grammar framework. The present experiment differs from Omanson's in emphasising thematic rather than causal relations, using more varied material, and defining peripheralness (a sort of reversal of centrality) not by the links between individual clauses (that is more like 'clause level') but by the relationship between clauses and some general notion of the point or purpose of the story, not necessarily specified in any particular clause.

Subjects

Thirty-six students (17 male and 19 female), mostly undergraduates and from a variety of disciplines, took part in this study. All were volunteers, paid a small for participation, and all had taken part in one other experiment (I or II) over the preceding months.

Materials

Two passages, 'P' and 'Q', were specially written for this experiment to the same criteria of style and word and clause length developed for the passages for Experiment I. Both were 'branching' narratives (structural type 2). There were three versions of each; the central 20 clauses were the same throughout, but the beginnings and endings differed. The versions for each passage were:

1. An 'ordinary' version in which the purpose was announced (was 'explicit') at the outset, was dealt with in the central section, and resolved or concluded in the final section. The central action sequence then had a definite 'purpose' to define clear relations with the other clauses.

2. A version where the purpose was 'implicit', ie not stated in the opening section but inferable from the ending, in the light of which the central section would have to be interpreted. Relationships among the clauses would be weaker, particularly between the central section and the

beginning.

3. A third version ('absent') of each passage in which no purpose or reason for the central sequence of action was provided or could be inferred in either the beginning or the end. Here, the relationship among the clauses was weakest of all.

It was predicted that the central sections of 'explicit' versions ('Pe' and 'Qe') would be recalled best and those of 'absent' versions ('Pa' and 'Qa') worst. 'Implicit' versions ('Pi' and 'Qi') were expected to be intermediate in level. The sections from which the versions of each passage were constructed are reproduced in Appendix 1.3.

Design

Every subject received both passages in the same session. Subjects received different 'versions' of each of the two passages, order of presentation being counterbalanced so that each of the 12 possible passage-version pairs were received by 3 subjects. Subjects were randomly allocated to orderings, and the order of passages for each subject is given in Appendix 2.7. Data *from the central section only* was analysed separately for each passage in a 3 x 2 independent groups factorial design, the factors being version and order of presentation/recall.

Instructions

The instructions were a simple modification of those used for Experiment I, retaining Experiment II's single reading of each passage. This was intended to avoid the possibility, with implicit versions, of subjects' knowing the aim of the passage at the beginning of the second reading from having already read the ending. The only other alterations to the original instructions were to accomodate the different number of sessions and passages and the shorter session length.

Procedure

Except for the instructional differences already noted and for there being only two passages and one session, the procedure duplicated that of Experiment I in all respects. Sessions lasted an average of 25-30 minutes.

Results

Raw data for clause recall and word-scores is presented in Appendix 3.6 and passage and condition means in Appendix 4.9. There are surprisingly few differences of any size associated with experimental factors for either passage: implicit and absent versions are marginally less well recalled for Passage P than than for Q and there seems to be a beneficial effect on the recall of P from presentation second, which does not hold for Q. Analyses of variance on the data are given in Appendix 4.10 and summarised in Table 4.17.

Table 4.17: Experiment IV: summary of anova results on clause recall and word-scores

Passage P

	F-ratios on		
	Version	Order	Interaction
Variable	df = 2,30	df = 1,30	df = 2,30
Clauses	1.21	3.09	1.13
W	2.51	3.90	<1
V	1.24	6.26 *	<1
X	<1	2.50	<1
I	8.11 **	2.59	3.56 *

** $p < 0.01$

* $p < 0.05$

Passage Q

	F-ratios on		
	Version	Order	Interaction
Variable	df = 2,30	df = 1,30	df = 2,30
Clauses	<1	<1	<1
W	<1	<1	<1
V	<1	<1	<1
X	<1	1.70	<1
I	<1	<1	<1

For Passage P there are no significant effects for version on either clause recall or total words recalled; there are significant effects on intrusions from version and (marginally) the version x order interaction. The only other significant finding is a weak effect of order on verbatim recall. Passage Q produced no significant effects whatsoever. It must be concluded that no trace of the predicted effect of decreasing recall across story versions 'e', 'i' and 'a' could be found.

Discussion

Quite obviously, the results of this experiment were a surprise and a disappointment. The resounding failure to find any significant effects of note in the data may be ascribed to either or both of the following causes:

1. The experimental materials did not create the differences in purpose for the central clauses that were intended, or allowed easy assumptions about purpose by which to interpret the central 20 clauses even the 'absent' versions.

2. There is no real 'peripheralness' effect present to distinguish between the better and worse recalled clauses. Or if there is, conditions were such that subjects were unable to utilise it (perhaps by not being able to extract the 'purpose' from the passages).

It seems unlikely that the peripheralness effect exists but that subjects' strategies prevented them for being influenced by it, otherwise the effect not have been noticed in the data of Experiment I. In support of the first point above, the passages cannot be said to be dramatically different in their comprehensibility, and a brief qualitative inspection of subjects' scripts suggested that the 'a' beginnings had been interpreted as stating purposes or intentions for the rest of the passage. Passage Qa was widely interpreted to be an account of the Ben Alreth's holiday, and Pa was taken to be an account of whatever job of work John's father had given him to do (cf Appendix 1.3). Looked at in these terms, the phrasing of the passages for this particular study was unfortunate. Nevertheless, despite probable methodological failings, the possibility remains that thematic relations of this type (between clauses and some higher level unit or feature) do not play a role in story comprehension under the conditions of these experiments.

4.10 CONCLUSIONS

In this chapter, a set of materials was specially written for the first experiment, and a simple procedure established; both of these will serve as blueprints for another four experiments. A direct start was also made on the two main issues in the memory representation of text. Here, there was more limited success.

On the interdependence of verbatim and propositional memory, the difference discovered between the behaviour of verbatim and nonverbatim recall appeared to be very clear, but somewhat unexpected, particularly when studied across passages. This will be explored further: in terms of other experimental factors (Chapter 5) and by a detailed qualitative examination of the two recall components (Chapter 7).

A simple characterisation of the differences among clauses of different recall frequencies seemed plausible at one point, especially as it related the recall of individual clauses to broad properties of their passages. Attempts to confirm this observation met with repeated failure, although interpretation of the negative findings was confused by possible defects in the materials employed. Although qualitative analysis will be returned to in Chapter 7, the next investigations of the role of thematic relations (Chapter 6) will be more structurally based.

Some simple structural observations were made in Section 4.6, with the main conclusion that 'clause level' as defined here is associated with clear variations in clause recall, according to prediction. It has already been mentioned (Section 3.6) that clause level effects are seen with many different definitions of levels, but it does confirm that the structural relations described for Passages 1A-3C have at least a degree of psychological validity.

CHAPTER FIVE

VERBATIM RECALL AND TEXT PROCESSING

5.1 INTRODUCTION

Verbatim recall

Verbatim recall is an important topic of enquiry because of what it might tell us about the propositional level of text encoding. Previous research has suggested that the verbatim recall of story-like material under normal circumstances most likely reflects the accuracy of the propositional (detailed semantic) encoding of text-derived information ('accuracy hypothesis'). From this conclusion one would expect verbatim information to behave similarly to overall recall, except where there were substantial effects on recall accuracy.

In Experiment I, verbatim recall was seen to vary substantially across the independent variables of subject and order of presentation, both of which might reasonably affect recall accuracy; less easy to explain were similar variations across passages. In all cases, nonverbatim recall varied little or not at all. The variations with subjects and order, though not predicted, were not inconsistent with the accuracy hypothesis, but the passage effect shifted the balance of support towards the alternative parallel hypothesis. One other explanation was the existence of biases in the application of the scoring criteria, though none could be suggested.

Clearly, if analysis of verbatim recall is to be used to examine the finer details of text memory, it is vital to know whether it represents aspects of propositional encoding or something quite separate. The first purpose of the next two experiments is to help resolve this problem by introducing further experimental manipulations in an effort to explore the limits of the behaviour seen for verbatim recall in Experiment I. As a bonus, if any opposing pattern of results can be demonstrated for any factor, the persistence of the previous pattern cannot then be attributed to scoring artefacts. The data collected might also provide extra scope for later, more searching, analyses of the verbatim component.

Processing manipulations

Experiment II planned to vary the accuracy demanded by the recall instructions given to subjects in an attempt to directly affect the manner of recall, or at least the manner of overt reproduction of recalled material. If verbatim recall just reflects the recall of accurate information, instructional variations should influence the less accurate nonverbatim component only. On the other hand, if verbatim recall is an independent form of coding from propositional representation, variations in verbatim recall too are possible. Thus, instructional effects on verbatim recall would contradict the accuracy hypothesis, while the absence of such effects would lean towards it, but would not entirely eliminate the parallel hypothesis.

In Experiment I it was noted that the instructions given, while trying to tread a middle road between accuracy and quantity of recall, might have appeared sufficiently ambiguous to subjects to create significant individual diferences and variations in their interpretation, and this could have contributed to the results obtained. By deliberately giving different instructional stresses about recall accuracy to different subjects, it would be possible to ascertain what effects such interpretive variations might have produced, and so assess their possible contribution to the results of Experiment I.

Recall after a long interval of about a week, instead of the usual few minutes, was the manipulation chosen for Experiment III. Under these circumstances, it would be likely that most components of recall would decline; however, if verbatim recall corresponds to the most accurately encoded propositional information, a longer interval should affect this much more than overall recall, assuming that in forgetting it is the finer details that 'degrade' first. For Experiment III, therefore, a greater decline over this interval of verbatim than nonverbatim or overall recall would be predicted. Under the parallel hypothesis, there is no reason to suppose differential rates of forgetting, though these cannot be excluded. If such a simple view of the results of Experiment III seems insufficient to distinguish the two positions, qualitative examination of the exact nature of the decline in the accuracy of verbatim and nonverbatim material (Chapter 7) can provide additional information.

A subsidiary justification for the manipulations introduced was to alter the way in which subjects *processed* text. Although text processing *per se* is not a focus of the present Thesis, what we discover about the nature of the memory representation is dependent on the processes of acquisition and recall, and any changes occurring during retention, and studying these stages should tell us more about the mental representation. Varying the recall instructions should influence the what happens at recall and possibly acquisition, and recall delay would affect retention and possibly recall. The choice of independent variables afor Experiments II and III tried to take this into account.

5.2 EXPERIMENT II

Introduction

In this experiment, the recall instructions to subjects were varied to observe their effect on what was reproduced. Three types of instructions were devised, stressing accuracy of recall or quantity of recall as the most important considerations for subjects, or attempting to strike a middle course (like Experiment I). Fewer passages were also administered, but in other repects, Experiment II was almost identical to Experiment I.

Subjects

Subjects were 36 students (15 male, 21 female), mostly undergraduates and from a variety of disciplines. All were volunteers, paid a small sum for participation, and none had any prior experience of such an experiment.

Passages

Three of the passages from Experiment I were selected: 1A, 2C and 3B (see Appendix 1.1). Each type of structure and content is represented among them just once, and none had previously shown extreme or atypical behaviour on clause recall or the word-scores.

Design

Each subject received all three passages in a single session and condition. Within each of the 3 instructional conditions, each of the 6 possible sequences of passages occurred twice, forming 4 unbalanced Latin squares. Subjects were randomly allocated to instructional conditions and passage sequences, there being 12 subjects in each condition. The experiment was therefore a 4-way factorial design with factors of squares and instructions between subjects, and passages and order within subjects. The allocation of subjects to conditions and passage sequences is set out in Appendix 2.4.

Instructions

The preliminary, reading and debriefing instructions given to subjects were either the same as or a simple modification of (to account for the different number of sessions etc) those used in Experiment I. The 3 sets of recall instructions were variations on the original ones as follows:

1. 'Precise' instructions (P) stressed accuracy of recall.

2. 'Normal' instructions (N) were very similar to those used in Experiment I, attempting to balance accuracy against quantity of recall.

3. 'Liberal' instructions (L) stressed quantity of recall.

Full versions of the recall instructions are reproduced in Appendix 2.5. Complete versions of all instructions were again given only on first presentation.

Procedure

The procedure followed closely that of Experiment I in all respects except two:

1. Subjects in all conditions were asked to read each passage once, not twice as before, in order to reduce any tendency to self-correction during a second reading which might otherwise have confused the effects of the recall instructions.

2. Each subject was read only the recall instructions corresponding to his own recall condition.

Sessions lasted about the same length of time as in Experiment I.

Results

No clause recall scores are reported here because it was thought that word-scores alone would present an adequate picture of differences between instructional conditions. Overall clause recall in Experiment I had generally followed the behaviour of W, but was probably less sensitive to experimental effects. Raw data from this experiment can be found in Appendix 3.3. Word-score means for differences among recall instructions, passages and order of administration (trials) are tabulated in Appendix 4.3 and shown graphically in Figure 5.1. Anova results are presented in Appendix 4.4 and summarised in Table 5.1.

Table 5.1: Experiment II: summary of anova results on word-scores

Word-score	F-ratios on Instructions df = 2,24	Passages df = 2,60	Order df = 2,60	
W	3.988 *	4.566 *	18.55 ***	**** p << 0.001
V	<1	1.809	42.89 ****	*** p < 0.001
X	13.57 ***	2.267	1.223	** p < 0.01
I	5.478 **	4.882 *	<1	* p < 0.05

In general, each of the three factors (instructions, passages, order) was associated with variations in one or more of the word-scores. In the figure, variations across trials and passages repeat the pattern found in Experiment I. While instructions are also associated with variations in W, it is differences in X and possibly I which account for this, not changes in V as before. The analyses of variance on the same data tend to confirm this:

1. Instructions were associated with little variation in V, but with the most significant differences in X and I of any of the factors examined.

2. Passages showed (marginally) significant differences only for W and I.

3. Order of presentation was associated with significant differences in W and V, but not X or I.

None of the interactions in the analyses reached significance. The effect of instructions is thus established as a producing a very different pattern of results from any other factor in either Experiment I or the present study. The failure of significant effects to be found here with passages is not surprising, given that the three passages used here were chosen for their *similarity* in the earlier experiment.

Table 5.2: Experiments I and II: comparison of word-score means

Data	Word-score means W	V	X	I	Number of subjects
1. Experiment I: actual scores	165.5	94.3	53.5	17.8	18
2. Experiment I: corrected scores	157.8	87.2	52.3	18.3	18
3. Experiment I: session 1 only	152.7	78.9	53.8	19.9	(12)
4. Experiment II: actual scores	136.5	71.2	52.3	13.3	12

Table 5.2 tries to compare the present results using 'normal' instructions with data from Experiment I *using the same passages,* to see if any differences can be associated with reading a passage once rather than twice. The Experiment I results require some explanation:

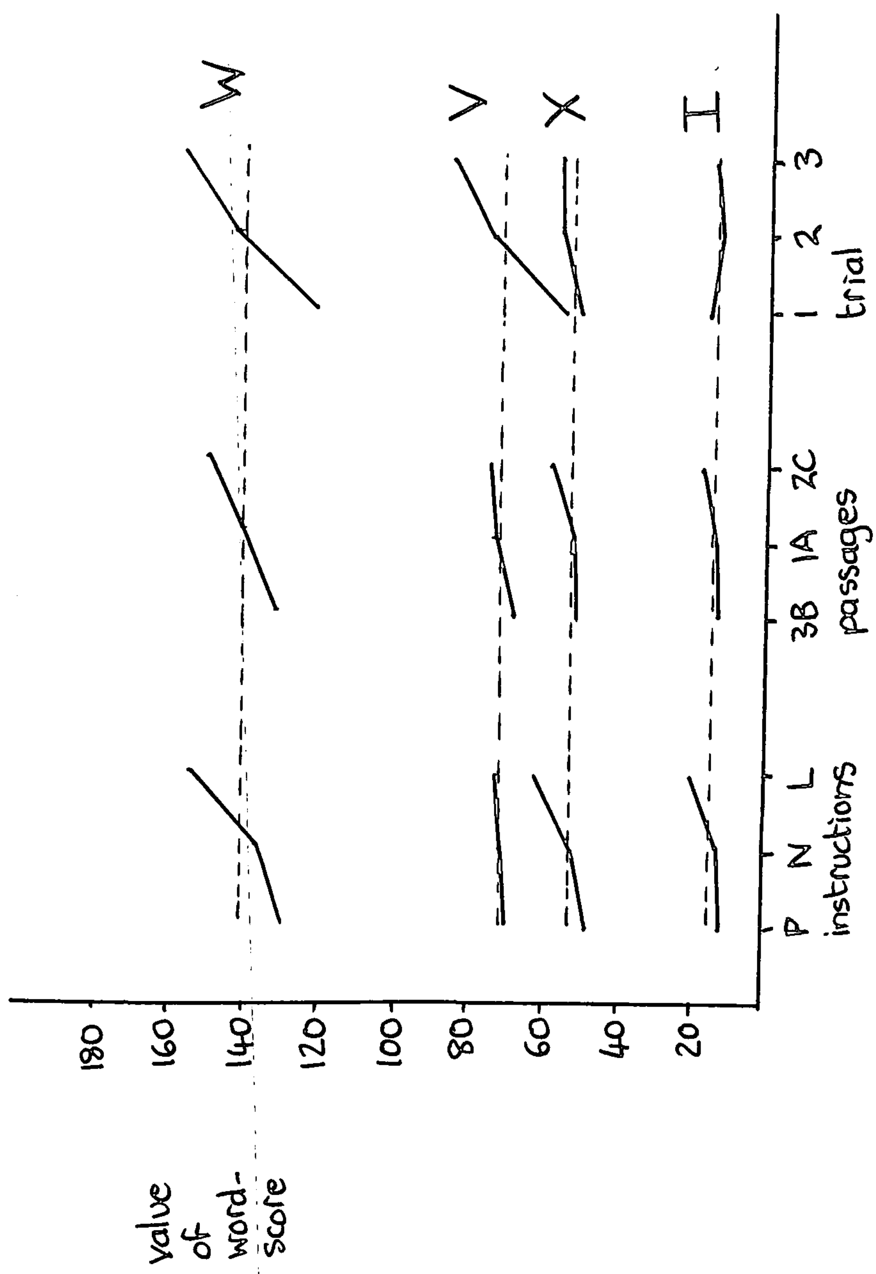
1. 'Actual results' refers to the means over all 3 sessions.

2. 'Corrected results' represents what first session recall *might* have been like, using other data to reduce 'actual results' to the level of first session recall, assuming additive effects.

3. 'Session 1 only' consists of just those results from subjects who took one or more of the passages in the first session: only 3 subjects received all 3 passages on this session.

The comparison between lines 2 and 4 is probably the most reliable because of the number of subjects involved. Such a comparison is hazardous, but does indicate probable trends. Examination of the table suggests tentatively that reading a passage once instead of twice reduces both W and V substantially, ie it reproduces the pattern of results obtained here and in Experiment I for subject, passage and other effects.

Figure 5.1: word-score means plotted by instructional condition, order of presentation and passage



Discussion

The main finding from this experiment is that the variations in recalled material produced by instructional differences were the opposite of those already demonstrated with several other factors: the difference was in fact quite stark. As argued above, the relative constancy of verbatim recall across instructional conditions, despite large variations in the other components, is strong support for the view that verbatim recall represents the recall of *accurate* information. Accurate information must be recognised as such by subjects: if the instructions cause subjects to set an accuracy-based editing criterion at different levels, only the amount of less accurate information recalled would be then be affected, producing no changes in verbatim recall. Though the parallel hypothesis does not predict that an effect like this would *not* take place, it certainly fits more easily into an accuracy interpretation of the interrelation of propositional and verbatim memory.

Secondly, two possible methodological problems are eliminated by these results. Obtaining so different a pattern of results with even one factor means that the repeated finding of variations in only the verbatim component cannot be due to some unknown scoring artefact. In addition, the fact that differentially stressing recall accuracy produces a pattern of results not found elsewhere, implies that the earlier findings cannot have been the product of individual differences and inconsistencies in the interpretation of instructions.

5.3 EXPERIMENT III

Introduction

Experiment III was an attempt to compare the immediate recall of prose passages with recall after a moderate delay. There were two types of delayed recall: with and without prior immediate recall, permitting comparisons between any pair of immediate recall, delayed *first* recall, and delayed recall following an immediate first recall. The experiment followed previous practice with two main changes: there were two new passages, and it was necessary to deceive subjects about the nature of the second session.

Subjects

Thirty-two students (12 male, 20 female), mostly undergraduates and from a variety of disciplines took part in this experiment. All were volunteers, paid a small sum for participation, and all had taken part in previous experiments in the current series: 27 had done Experiment II, 5 Experiment I and all Experiment IV.

Passages

Two passages, S and T, were written for this Experiment, according to the criteria established for Experiment I. Both were 225 words long, of 'branching' structure (type 2) and familiar or domestic content (type B). The passages are reproduced in Appendix 1.2.

Design

All subjects attended 2 sessions. In the first session, half of the subjects (16) read Passage S first, and half Passage T, and in both of these groups half recalled S and half T in that session. In the second session, all subjects were asked to recall both passages: of the 8 subjects in each session 1 condition, 4 recalled in each order. Thus, in session 1, there were 4 groups of 8 subjects constituting a 2 x 2 factorial design, the factors being order of reading and passage recalled. Session 2 gave a 2 x 2 x 2 factorial design *for each passage,* the factors being order of reading initially, whether recalled in the first session, and order of recall in the second session.

Instructions

The instructions for Experiment III were adapted from those used in Experiment I, but are given in full below because of the number of changes. The principal differences were:

1. To accomodate the two sessions and two passages.

2. To introduce false expectations of the second session, to minimise consideration of the passages between sessions.

3. To accomodate the very different circumstances of recall in session 2, especially by the introduction of recall cues. These cues were the same for all subjects, were given whether required or not, and were designed to be of greatest assistance while supplying the minimum amount of the most 'obvious' information.

Again, repetition of instructions used suitable abridgements.

Procedure: first session

Subjects were again tested individually or in pairs in a typical study-bedroom. Once settled, they were read the preliminary instructions:

"This is another experiment to find out how people understand and remember prose passages of various sorts. In each of the two sessions, there will be two passages of the usual length, again on slips of paper. Each session will probably last about half an hour. Stop me at any point if you are unsure about anything. Again, you are asked not to mention anything about the experiment to anybody else involved as this could invalidate their results."

Subjects were then given the first passage as usual and read the next instructions:

"You have now been given the first passage of the session. You should reach it *once* through only, *at your normal reading speed;* remember, once only. I want you to read each just as you would read a passage in a book or a newspaper. I only want you to follow the passage quite normally, to understand it, and if possible to enjoy it. I do *not* want you to make any special effort to commit any of it to memory. In particular, I am not interested in how accurate your memory is for the precise wording of the passage. Are there any questions? Right, begin when you are ready and let me know when you have finished."

After subjects had read the passages, the following instructions were read out:

"This time, I do not want you to recall the passage you have just read, but to read the second passage of the sesion straight away. Here is the other passage. [*Subjects were given the next passage.*] I would like you to read it through *once* only, quite normally, just as before."

After reading the second passage, the passage was collected, and pens and paper distributed for recall. The following recall intructions were read, alternative phrasing being chosen according to the condition the subject had been assigned to:

"Now, I want you to recall [the passage you have just read / the first passage you were asked to read], not [the first passage / the one you have just read] which was presented as interfering material only. I would like you to write down as much of it as you can remember, in prose rather than note form. I am not interested in the exact words used originally, but if you do happen to remember them, by all means use them. Take your time over this, there's no need to hurry. If there's anything you remember you are not sure about, *underline* it in your account. When you have finished, check through what you have written, making additions and corrections as you want. You can use footnotes if you wish. Spelling and punctuation don't matter. Are there any questions? Right, begin when you are ready, and let me know when you finish."

After the usual recall period, subjects were reminded to check through their scripts, and the sesion ended with the statement:

"Right, that ends the first session. I know it was rather short, but I am not interested in the passage you did not recall which, as I said, was for interference purposes only. Some people receive it before, others after the one to be recalled. In actual fact, you probably won't have experienced much confusion between them, but the passages in the next session will be much more difficult. Can I remind you again not to mention this session to anybody else taking part."

Session 1 lasted about 20 minutes on average.

Procedure: second session

The second session was arranged, whenever possible, for 7 days after the first, which proved so for 20 of the 32 subjects. Overall, the mean interval was 7.75 days (sd 2.72) with extremes of 2 and 14 days. The second session began with the following statement:

> "You are not going to be given any passages to read this session. I shall simply ask you to recall *both* of those presented to you last time. I'm sorry if this sounds sneaky, and that you've been deceived, but it was the only way to prevent you going over the passages too much between sessions."

Typically, this statement was with remarks disclaiming any ability to remember. They were told not to worry about this yet and were asked whether they had suspected anything like this would happen: gratifyingly, few had. Pens and paper were then distributed and the recall instructions read, alternatives being chosen according to condition:

> "Now, I want you first to recall the passage you [did / did not] recall last time; that is, the one you read [first / second]. I can give you a clue to get started for this passage; the clue is: ['little Willy and his toy and his finger' / 'a man with a tape recorder and a bird']. Okay? Now, I want you to write down as much of the passage as you can remember. Whereas I would prefer prose rather than note form, if you have any difficulty in remembering, you may put down material and thoughts in *note* form in any order you please, provided you indicate as much order as you can afterwards. I am not interested in the exact words used originally, but if you do happen to remember them, so much the better. Take your time, there's no need to hurry. If there is anything you remember you are not sure about, underline it in your account, unless this would mean underlining the whole lot, in which case don't bother. Spelling and punctuation don't matter. Are there any questions? Right, begin when you are ready, and let me know when you have finished."

When finished, they were given a fresh sheet of paper and read a suitably amended and abridged version of the recall instructions for recalling the other passage. All subjects managed to recall something without undue difficulty; they were allowed to ask for repetition of the clue, and were encouraged to write it down somewhere, if necessary, but to keep it separate from what they recalled. After the second passage, they were permitted to check through both accounts, and were reminded not to discuss the session with anybody else who might be taking part. Those who wished were given a (genuine) description of the nature and purpose of the experiment. Session 2 lasted about 15 minutes on average, though a few subjects took nearly an hour.

Results

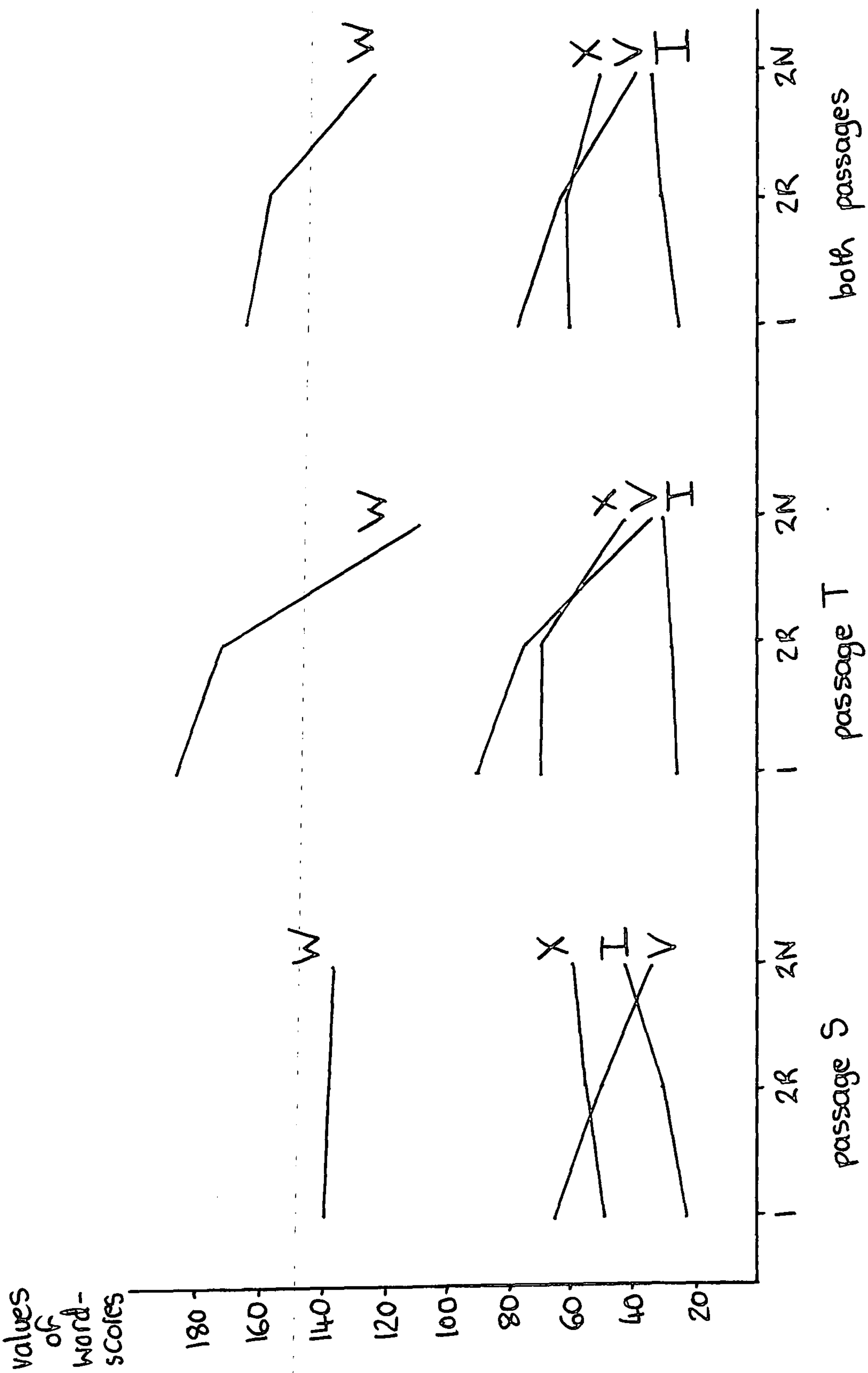
Figure 5.2 shows the main results of the experiment, for the passages separately and combined, for the three main conditions: session 1 recall ('1'), and session 2 recall with ('2R') and without ('2N') prior session 1 recall. The tables of means on which the figure is based are reproduced in Appendix 4.5, with the corresponding raw data in Appendix 3.4. Analyses of variance on session 1 results (passages together) and on session 2 results (passages separated) are reported in Appendix 4.6 and summarised in Table 5.3: results for interactions failed to reach significance in all but two marginal cases.

Table 5.3: Experiment III: summary of anova results on word-scores

		---F-ratios on---			
Session/ Passage	Word- score	Passages df=1,28	Reading order df=1,28/24	Recalled before df=1,24	Recall order df=1,24
	(W	25.90 ****	1.15		
1	(V	11.24 **	<1		
(S&T)	(X	30.13 ****	3.57		
	(I	<1	1.64		
	(W		5.04 *	<1	5.53 *
2	(V		<1	14.72 ***	3.75
(S)	(X		5.05 *	1.31	4.91 *
	(I		3.05	2.52	<1
	(W		<1	32.19 ****	15.38 ***
3	(V		<1	47.89 ****	7.07 *
(T)	(X		<1	31.93 ****	5.53 *
	(I		<1	<1	7.21 *

**** $p << 0.001$; *** $p < 0.001$; * $p < 0.05$

Figure 5.2: word score means plotted by passage and experimental condition



One problem with these results was that the two passages behaved rather differently from each other across experimental conditions, restricting the generality of the conclusions which could be drawn. In addition, Passage T was recalled exceptionally well by the standards of the other experiments in this thesis, suggesting that it is perhaps Passage S which is the more typical of this kind of material.

The figure indicates that across the three main conditions, both there was a substantial decline in V and a small increase in I for both passages. Nonverbatim recall, X, increased slightly for S across conditions 1-2R-2N, whereas for T there was a sharp decline in 2N (recall for the first time in the second session) compared with the other conditions. Overall words recalled, W, reflected this anomaly, remaining virtually constant for S, but dropping precipitately in 2N for T. Thus the first session recall for T was much better than for S, but T suffered a large recall decrement with delay of first recall whereas S did not.

Table 5.4: Experiment III: comparison of word-score data from first recall attempts, sessions 1 and 2

			Word-score data			
			W	V	X	I
Passage S	Session 1:	mean	140.1	66.0	50.1	24.1
		s.d.	28.4	21.8	10.5	9.5
	Session 2:	mean	135.6	33.1	59.0	43.6
		s.d.	42.0	18.3	15.0	29.4
2-tailed t-test on		t	0.355	4.624	1.944	2.525
difference, df = 30		p	n.s.	<0.001	n.s.	<0.02
Passage T	Session 1:	mean	185.9	90.0	69.6	26.4
		s.d.	22.2	18.0	10.5	12.0
	Session 2:	mean	108.0	33.4	43.4	31.3
		s.d.	42.0	12.8	16.7	15.1
2-tailed t-test on		t	6.559	10.250	5.313	1.016
difference, df = 30		p	<0.001	<0.001	<0.001	n.s.

The anovas confirm these trends (Table 5.3). The only significant factor in session 1, with W, V and X, were passage differences. In session 2, the only important agreement between the two passages is a significant effect on V from whether the passage was read before: there was a similar effect on W and X for Passage T, but not S. Order of recall in the second session seemed to be associated with marginally significant effects on all variables for one or other passage, and a highly significant effect on W for T. A comparison of *first* recall in sessions 1 and 2 is presented in Table 5.4, using t-tests: both passages showed that delaying recall significantly decremented V, but there was no agreement on W, X or I.

<u>Table 5.5: Experiment III: analysis of changes between the first and second reproductions of a passage</u>

		Change		2-tailed t-test df = 15 / 31		2-tailed binomial test changes				N
Passage	Score	mean	s.d.	t	p	+	0	-	p	
	(W	-1.7	25.5	0.267	n.s.	6	1	9	0.60)	
S	(V	-13.0	15.4	3.377	<0.01	2	0	14	0.0042)	16
	(X	+4.5	11.2	1.607	n.s.	12	0	4	0.077)	
	(I	+6.8	12.3	2.213	<0.05	9	2	5	0.42)	
	(W	-12.8	25.6	2.000	n.s.	4	0	12	0.077)	
T	(V	-16.2	13.6	4.765	<0.001	1	0	15	0.00052)	16
	(X	+1.4	13.5	0.415	n.s.	10	0	6	0.45)	
	(I	+2.0	14.3	0.559	n.s.	7	0	9	0.85)	
	(W	-7.2	25.7	1.584	n.s.	10	1	21	0.072)	
Both	(V	-14.6	14.4	5.736	<0.001	3	0	29	0.0000026)	32
	(X	+2.9	12.8	1.282	n.s.	22	0	10	0.050)	
	(I	+4.4	13.8	1.803	n.s.	16	2	14	0.86)	

Table 5.5 tries to compare the two recall attempts from the same subject where subjects recalled passages twice. This is done for each of the four word-scores in two ways: t-tests comparing mean changes with zero change, and binomial tests on the numbers of subjects who showed changes in each direction, the latter occasioned by the often considerable departure from normality present in this data. The only important finding from these analyses is a significant decline in V over the 7-day period for both passages.

The differing behaviour of the two passages, and the exceptional recall of

Passage T, are serious problems because they limit the generalisability of the present findings. The possibility of inadvertent systematic differences between the groups of subjects recalling S and recalling T in the first session was investigated by looking at their performance on earlier experiments and 'correcting' the results of this experiment accordingly. Full details are given in Appendix 4.7. No significant differences between the two groups of subjects were found, with the possible exception of I, and corrections applied to the data of this experiment did not affect the pattern of findings in any important way.

Discussion

The main purpose of Experiment III was to investigate the relative decline of verbatim and other recall after a moderate interval from the presentation of a passage. The most important comparison, between immediate and delayed first recall, indicated that verbatim information declined massively with delay, and the nonverbatim component either showed no decline at all (Passage S) or a much smaller one than did verbatim recall (Passage T). Comparing first and *second* recall attempts by the same subjects also showed a large and highly significant decline in the verbatim component, but no other important effects. Despite certain anomalies, therefore, it can be concluded that the results lend most support to the accuracy interpretation of verbatim recall.

One problem raised by this experiment is that the results were somewhat confused by the two passages behaving rather differently from each other across the 3 conditions. To add to the confusion, Passage T was unusually well remembered, with better immediate recall than any passage in Experiment I. The only suggestion to be offered at this stage is the impression gained from scoring that the content of Passage T was somehow more *predictable* than that of Passage S.

5.4 CONCLUSIONS

Taken together, the results of these two experiments support the idea that verbatim recall is produced from the finest, most accurate detail in the (propositional) memory representation. This accurate information is recognised as such by subjects because they appear only to edit nonverbatim information when given recall instructions which vary the stress upon accuracy. It is also lost more quickly than other information over interval of a week. While these conclusions are necessarily tentative, the picture they create is coherent and consistent with some general properties of memory: editing processes which select among the information recalled for what is to overtly reproduced; and a slow degradadtion of information during retention. The qualitative analyses of Chapter 7 will attempt to confirm and extend these findings.

Having, albeit provisionally, dismissed the 'parallel' hypothesis of verbatim recall, it remains to use analyses of verbatim recall to tell us something about the propositional level of the memory representation of text. Among the questions which immediately arise are:

1. How distinct from other levels of representation is the 'propositional' level? Is it a single definable level at all?

2. What sort of information is contained within propositions, and how are they structured?

3. How are propositions used in various memory processes, especially, how is their information lost?

Using the information from Experiments I-III, these questions will be taken up again in Chapter 7.

CHAPTER SIX

STRUCTURAL ANALYSES

6.1 INTRODUCTION

Knowledge-led and text-led structures

The purpose of this chapter is take a more detailed look at the structural features which influence the recall of text. In Section 4.1, a distinction was made between text-led and knowledge-led processing, which differ in their implications for the structure of the memory representation. Text-led theories, mostly influenced by the story grammar tradition, propose the existence of story 'schemas' in which causally related units or 'episodes' are the main structural component, together with a few scene-setting elements. While episodes may be units in a knowledge-led theory, equally important would be other units based on commonality of topic or theme and where causal relations might be absent. These units should be structured according to what we know about the items or events involved, not according to an abstract framework or set of rules. Ultimately, text-led structuring is independent of content while knowledge-led structuring depends intimately upon it.

The purpose of this section will be to distinguish between these two views by applying some exploratory structural analyses to data from Experiments I and II.

Analysing memory structures for text

In Chapter 4, story structure was explored in a three rather simplistic ways:

1. In terms of the serial position of constituents within a passage.

2. In terms of 'clause level' within plausible structural descriptions.

3. By qualitative description of the relationship between constituents and the overall story.

The first two methods refer to features 'built in' to passages, the last to techniques that were independent of any prior description of passage structure, and this difference exemplifies the two main analytic approaches to be found in the literature (cf Pellegrino and Hubert, 1982):

1. 'Confirmatory' analysis, which tries to confirm pre-existing structural relations or schemes, by testing or 'extracting' their predictions from the data obtained: prior expectations are the main determinant of the structures described.

2. 'Exploratory' analysis, where no organisational features are specified beforehand and the purpose of the analysis is to see what structures already exist in the data: the data itself is the main determinant of the results.

The literature has been dominated by confirmatory analyses: developing and testing models which have already been set up against experimental data. In a sense, most of the tests of text models in Chapter 3 fall into this category, and need not be discussed further. Exploratory analyses are more interesting, however.

The distinguishing feature of exploratory approaches is the absence of prior theoretical assumptions about the type structural features that might be of psychological importance. They emphasise statistical methods instead of theoretical predictions, and tend to be more complex in the kind of structures they tackle. Perhaps because of this atheoretical nature, they have not proved popular among researchers interested in discourse, although widely applied in the area of semantic memory and list learning (Friendly, 1979; Ornstein and Corsale, 1979). Exploratory analyses probably possess a greater capacity for distinguishing between alternative theoretical predictions than confirmatory analyses, and can more easily serve as a source of new ideas about structure. Their shortcomings are that a given set of data may produce quite different structures with different analyses, and that the structures obtained may not necessarily be psychologically meaningful (cf Reitman and Rueter, 1980). Despite such problems, the advantages of exploratory analyses greatly outweigh their disadvantages for the present research.

Examples of exploratory structural analysis

One of the few serious attempts to apply exploratory structural analysis to the free recall of text was reported by Harris and Terwogt (1978). A tree structure derived for a simple story from the recall protocols of older children was used to assess agreement among the reproductions of children of several age-groups. The tree structures were constructed by selecting, for each proposition (target) in turn, the proposition physically nearest to it in the passage which was *always* recalled when the target was recalled. This method has limitations:

1. In constructing its structural descriptions, it is biased towards connecting items that are close together in the story, overemphasising the importance of the linearity of the original passage.

2. The criterion of linking propositions only when one is *always* present when the other is recalled ignores *degrees* of relationship and may be particularly subject to chance effects.

In addition, Harris and Terwogt's definition of a proposition is unclear, producing some rather odd units. On the other hand, despite the size of the discourse memory literature, few workers have come up with a better solution to the exploratory analysis of structure.

Kintsch (1977b) reported a study by Kozminsky in which subjects were asked to group the paragraphs of a story into as many categories as they wished, and the resulting groupings subjected to a form of cluster analysis. Despite good agreement with predictions, Kintsch admitted that this was "not a very stringent test" of his macrostructure theory, on this occasion using structural components much like those of a story grammar. A comparable investigation by Micko (1982) had subjects divide a text into sections, subsections and so on as the basis for analysis. Both methods may tap features of importance in memory, but it is difficult to see how they can be applied to the analysis of free recall data unless their results are directly compared with those from free recall.

Another interesting exploratory technique used in a limited way is to use the answers to questions asking for reasons and causes to devise structure among the elements of a story. Graesser, Robertson, Lovelace and Swinehart (1980) presented subjects with familiar fairy stories and noted the number of answers that were given in response to why-questions about actions contained in them. Graesser et al. argued that "when an action is structurally subordinate, there are more superordinate constituents to act as sources of answers to the why-questions" (p.112). The results of this study suggested that the recall of actions was determined by two general dimensions along which they could vary, but the authors did not extend the implications as far as a structural model for text. It would also seem difficult to extend this approach to more varied passage content.

Reitman and Rueter (1980) proposed a method for eliciting structure from what subjects' recalled that was sensitive to linear and hierarchical features, but it was founded on the heavily restrictive assumption that "items are organised into chunks and that the subject recalls chunks as units, recalling all of one chunk before proceeding to the next" (p.559). Applied to the recall of *lists*, Reitman and Rueter's technique was able to 'recover' structure they knew had been present initially. However, they did not apply it to the recall of discourse.

In general, researchers have not *compared* alternative analytic approaches. One notable exception is a study by Peterson and McCabe (1983) in which three different techniques were applied *in parallel* to children's narrative productions. The analyses were based on:

1. 'High points', after the work of Labov (eg Labov and Waletzky, 1967) in which narratives are supposed to be organised around certain points critical to the action or important for the narrator.

2. 'Episodes', following on from the structural analyses of story grammars.

3. 'Syntactic dependency', a rather abstract approach to the coherence among the propositions of a narrative, the consequence of which is to produce a hierarchy of logical relations (Deese, 1981).

Peterson and McCabe were primarily interested in the analysis of the free *productions* of individual children, which is a considerably different situation from studying the free recall of groups of adults. Of the three techniques, story grammars have already been discussed (Chapter 3); 'syntactic dependency' is explicitly content free, and other problems make it inappropriate for present purposes; and 'high point' analysis, despite superficial similarities with Wilensky's (1983) 'story points', is primarily interested in narrative productions and in pragmatic rather than content factors, and is not capable of easy adaptation to free recall.

Conclusions

The avoidance of genuine structural analyses in the discourse recall literature, exploratory or not, is astonishing, and the limitations of some of those studies that have attempted exploratory structural analysis have already been pointed out. One interesting case is provided by Black and Bower (1979), who acknowledged that if information is 'chunked' in memory, it would be expected to be recalled together as a chunk, and their arguments led logically to cluster analysis or some related technique. But when it came to designing an experiment, they curiously avoided structural analyses and free recall, and went on to investigate memory for simple narratives by recognition tasks from which no clear structural conclusions were possible.

Many theories, including the rather generalised knowledge-led and text-led approaches, make easy predictions about what should and should not be related together in memory, and this in turn predicts what should or should not be recalled together. Predictions of this kind tap features central to their theories and are powerful and straightforward methods by which to distinguish the theories empirically. All that is required is an analytic approach that is simple, flexible and is capable of clearly differentiating between competing predictions.

Predictions

The rest of this chapter will examine the way in which passage constituents, here 'clauses', are 'chunked' or associated together at recall as a means of investigating the organisation of the memory representation. The statistical measures for this will be explained later, but will consist of the calculation of contingency coefficients on pairs of clauses from recall data, and a simple form of cluster analysis based on these coefficients.

Knowledge-led comprehension, it has been argued, would organise information together in memory by topic or theme. The organising together of causally related items would be predicted by both text-led and knowledge-led theories. In contrast, topically related items which are not causally related, eg several clauses all contributing to the description of an item or the non-causally related activities of an actor in a passage, would be expected to be associated on recall only if processing is knowledge-led. The only exception to this would be if the non-causally related items contained components of the same scene-setting information, when an association might be predicted by a text-led theory, but in any passage such items would be few. Thus, in the analysis of recall associations, it is the association of thematically related items which are *not* causally related that will distinguish the two approaches: if such groupings can be found in appreciable numbers, or numbers comparable to the associations of causally related items, then considerable support would be given to the knowledge-led position.

Clear associations between the recall of pairs of clauses within a passage are only measurable when the two clauses exhibit both recall and omission by several subjects. Data from a large number of subjects is therefore required, and thought should be given to the type of experimental material administered.

None of the experiments of the present research have so far employed enough subjects in any individual condition, so data for the contingency analyses has again been combined across the single condition of Experiment I and the three conditions of Experiment II, relying on the 3 passages 1A, 2C and 3B. The heterogeneous origin of the data was felt not to matter much because it was the *pattern* of recall not its overall level that was important. This problem was discussed in Section 4.7, and Kendall coefficients of concordance on clause recall in Table 4.11 indicated good agreement among the 4 experimental conditions.

6.2 RECALL CONTINGENCIES AMONG CLAUSES

Introduction

The first method of structural analysis is to calculate the degree to which each pair of clauses within a passage tends to be recalled together or omitted together, that is, their 'recall contingency'. Statistical probabilities may be calculated for these contingencies, to indicate how likely the association between two clauses is to have occurred by chance. Whether or not clauses lie close together in either original or reproduced versions, the technique should be able to demonstrate possible associations between items in memory, which can be given a structural interpretation, and help to decide between text-led and knowledge-led theories. Examination of the results should enable other patterns of association to be observed too.

Method

For these analyses, each possible pairing of clauses was taken in turn. A 2x2 contingency table was set up in which every subject was located as having recalled or omitted the first clause and recalled or omitted the second clause. A measure of the relationship of the two clauses in question could then be calculated from the table. There are several statistical measures of association for describing such tables, and these are discussed fully elsewhere (see for example: Siegel, 1956; McNemar, 1969; Leach, 1979; Cohen and Holliday, 1982). All are capable of giving misleading or unreliable results with certain contingency tables, especially where most of the frequencies fall into just one or two cells, a common occurrence with the present data.

The contingency coefficient (C) was chosen as representing the best balance of characteristics, in particular for its behaviour in the case when two diagonally opposite cells in the contingency table contained frequencies close to zero. Many measures of association give similar coefficients regardless of how evenly or unevenly the frequencies are divided between the remaining two cells. The contingency coefficient tends to decrease as this imbalance increases, and this was felt to better reflect what was happening to the association between the clauses. In cases where two orthogonally adjacent cells contained zero frequencies, the contingency coefficient could not be calculated, and was arbitrarily set to zero; this was justified because no association was in fact being demonstrated by the data. C normally falls some way short of unity for perfect associations, but this was unimportant, particularly as the number of items in each calculation was the same throughout.

The contingency coefficient has the disadvantage that by itself it does not distinguish between positive and negative associations. This was not held to be a serious limitation for three reasons:

1. Fisher exact probabilities were being calculated on the same data and these could be used as an indicator of the direction of the relationship if required.

2. Only positive associations were of theoretical interest: no predictions involved negative expectations.

3. Negative associations among the recall of clauses could well be scoring artifacts; this might occur in marking recalled material which combined information from two original clauses as having come from only one of them, in situations where subjects often combined the two clauses on recall.

Fisher Exact probabilities were calculated on the recall associations between every pair of clauses in each passage. As well as having intrinsic interest, these values enabled the identification of spurious or potentially misleading contingency coefficients, and could then be used to 'correct' the table of contingency coefficients by setting values of C to zero whenever p was greater than 50%. *Individual* Fisher significance levels cannot be taken at face value because of the very large number of simultaneous probabilities being calculated, but the actual distribution of levels of significance within each table could be studied and used as guide to interpretation.

Because of the large numbers of clause pairings involved, 435 for each passage, simple computer programs were written to calculate both contingency coefficients and Fisher probabilities.

Results: general

Recall data for each clause for each subject for the three passages is given in Appendix 5.3 and 5.5: Subjects 1-18 are from Experiment I, and 19-30, 31-42, 43-54 from conditions 'P', 'N' and 'L' of Experiment II respectively. Complete contingency coefficient matrices are also presented in Appendix 5.5, followed by the corresponding tables of Fisher probabilities, both quoted to two significant figures in 'exponential' notation. Finally, this appendix contains 'simplified' tables of contingency coefficients, ie the values have been set to zero wherever the Fisher probability exceeded 50% (implying a spurious relationship), and are given to two figures without the decimal point, for improved legibility.

Tables 6.4-6.6 are based on Appendix 5.3, and show clause recall contingencies, with symbols to indicate coefficient values. It is obvious that the three passages differ considerably among themselves in the overall level of associations among their clauses. This is summarised in Table 6.1, which shows the distribution of contingency coefficients from each passage.

Table 6.1: Experiments I and II: Passage 1A, 2C and 3B: distribution of clause recall contingency coefficients

Range of values:	00-09	10-19	20-29	30-39	40-49	50-59	60-69
Passage 1A:	278	98	36	19	4	0	0
Passage 2C:	357	51	14	9	2	1	0
Passage 3B:	223	115	61	21	10	3	2

Despite the pooling of data from several different experimental conditions, there are many clauses in the passages that are omitted by very few subjects. Such clauses cannot logically show any reliable degree of recall association with other clauses. Table 6.2 summarises omission data on the clauses of the 3 passages across all 54 subjects. Comparison of passages on these figures can indicate the relative liklihood of finding a large number of noteworthy recall contingencies within them. It is clear from this table that Passage 3B has the most frequently omitted clauses. Only 4 clauses were omitted by no subjects, all in Passage 2C. Low omission frequencies not only limit the observable contingency coefficients among clauses, but also the cluster analyses of the next section.

Table 6.2: Experiments I and II: Passages 1A, 2C and 3B: summary of omission frequencies of clauses across the 54 subjects

Number of omissions	Number of such clauses per passage 1A	2C	3B
0-4	10	10	4
5-9	6	7	5
10-14	2	2	6
15-19	1	3	5
20-24	4	2	2
25-29	3	3	5
30-34	1	1	1
35-39	0	2	2
40-54	1	0	0

Results: clause associations

Inspection of Tables 6.4-6.6 suggests that a large number of the high contingency coefficients are associated with just a few clauses and that it is clauses close to each other in passages that tend to be associated together. In Table 6.1, Passage 3B shows the largest number of medium and high contingency coefficients of any of the passages. This may in part be due to the greater number of high omission frequencies among its clauses (Table 6.2), but although Passage 2C has a considerably lower number of such coefficients than Passage 1A, its distribution of clauses by omission frequency is not unlike Passage 1A. Clause omission frequencies are not the only cause of passage differences: the differing nature of the relations among their clauses must be important too.

Taking the clause associations with the largest contingency coefficients from Tables 6.4-6.6 for further examination, we have a total of 71 clause pairings with C's of 0.3 or greater. While this value of C may not be particularly noteworthy, it is probably the largest that provides sufficient clause pairs for analysis. The 71 pairings are from a total of 1305 possible, and so constitute a highly selected group. Appendix 5.6 attempts to describe for each clause pair the probable nature of the association involved, and this data is summarised in Table 6.3.

Table 6.3: Experiments I and II: Passages 1A, 2C and 3B: summary of data on most associated clauses (C >= 0.3)

		---Passages---		
		1A	2C	3B
Distance	(Adjacent	5	5	10
	(Close	3	1	11
	(Others	15	6	15
Types of Relation	(Thematic	1	4	10
	(Causal	6	2	12
	(Consecutive	7	0	0
	(None obvious	9	6	14

From Table 6.3, it can be seen that 20 of the 71 clause pairs are adjacent to each other, and a further 15 are 'close', that is, separated by either one or two other clauses in the original story. This is hardly surprising since adjacent clauses will tend to be closely related any of in several different ways. Identifying the nature of the relationships involved was not especially successful and 29 of the associations contained no plausible relation at all: this might indicate an uncomfortable level of spurious figures in the data. Of those contingencies which could be described with some reliability, 15 were judged thematic (in a non-causal sense), 20 causal and 7 (all from Passage 1A) 'consecutive'. As explained in Appendix 5.6, a conservative principle was adopted, of marking relations 'causal' rather than 'thematic' where there was any doubt. 'Consecutive' relations were between two clauses in the same action sequence where a weak argument for causal connection could be made if a subject had omitted intervening material.

Discussion

Despite the equivocality of much of the data analysed, there do seem to be identifiable relations between clauses that are associated with their being recalled or omitted together. In addition, though the procedure for assigning clause pairs to categories was biased towards causal relations, reasonably clear thematic relations did emerge. Passage 3B showed the strongest recall contingencies among its clauses; this was expected from the way it breaks down into local topics more easily than the narrative passages, and from its greater number of more frequently omitted clauses.

Thus far, the evidence lends support to a knowledge-led position of discourse memory, but contingency analyses have serious limitations. The most important of these concerns the way clauses are examined only in pairs. It is clear from Tables 6.4-6.6 that the association of clauses into groups of 3 or more is not uncommon: analysing associations strictly in pairs may not produce a realistic description of the underlying structural features. Considering larger groupings of clauses might also tend to reduce the effect of spurious associations between particular pairs of clauses, and should enable aspects of the higher order structure within stories to be inspected. Knowledge- and text-led theorising make predictions about recall clustering, not just recall contingencies.

Table 6.4: Experiments I and II: Passage 1A: summary of clause recall contingency coefficients

KEY:

SYMBOL	VALUE OF C
	00-09
.	10-19
-	20-29
+	30-39
*	40-66

CLAUSES

Clause	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1																														
2																														
3	.	-																												
4		-	*																											
5	.		.	.																										
6	-																													
7																														
8			.	.	.		.																							
9			.	-			-	+																						
10			.	.	.		.	.																						
11					.																									
12					.	.			-		.																			
13			.	.		.	.		+	.	.	+																		
14								.	-	.		.	-																	
15		-	+	.			.		+			-																		
16			+	-			.	.	+		-	*	+	.	+															
17			.						-						.	.														
18	.		-			.		.				.			-		.													
19		.						.		.		.	.																	
20							.	.		-		+	.		-	.	-	.	.											
21		+	.	.		.		-	.			-			-			-		.										
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26		-	.	.	.			.										.	+			.	+		-					
27				.				-	+			.			.			+	.	.	*		.			.				
28												.	.			.														
29	.		-	.								.	.		.	-		+		.	.							+		
30				.								-	.			-					.							*	-	

Table 6.5: Experiments I and II: Passage 2C: summary of clause recall contingency coefficients

KEY: SYMBOL VALUE OF C

SYMBOL	VALUE OF C
	00-09
.	10-19
-	20-29
+	30-39
*	40-66

CLAUSES

Clause	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1																													
2																													
3																													
4		.																											
5		.																											
6																													
7																													
8			.																										
9																													
10																													
11		.		.		+	.			.																			
12																													
13						.			.	-	+																		
14			.	.		+				.	*		+																
15																													
16																													
17																													
18						+	.				.				.														
19						+					.							*											
20		-				.	-				.		.	.															
21		-					.													*									
22						.														.									
23				.														-	.	.									
24		.			.																								
25			.			.					-			-				.	.	-	-								
26		.	.			+		.			+		.	-				.	.						.				
27			.																	.	.								
28															.														
29					-	.													.							.			
30					.	-		-			.								.	.				.		-			+

Table 6.6: Experiments I and II: Passage 3B: summary of clause recall contingency coefficients

KEY: SYMBOL	VALUE OF C
	00-09
.	10-19
-	20-29
+	30-39
*	40-66

CLAUSES

Clause	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1																													
2																													
3	.	-																											
4		.	-																										
5																													
6					.																								
7		.	.		.	-																							
8		+	+	.		.	*																						
9			.		.			-																					
10			.																										
11			.	.		-	.	+	+	-																			
12		.		-				.		.	.																		
13		.	.	.				.				-																	
14		.	-	-	.				.		-	.	.																
15										.	.		-	*															
16		-		.	.		.	.	-		-	.	-	*	*														
17	.		*				.	.	.	-	-		-	-	-	-													
18			.		.	-	.				.					.													
19						*	.	.	.		-					-	-	*											
20						*	.	-	.		.				.	-	.	*	*										
21					-		.	.					.			-		.		.									
22					.																+								
23					-		.	.		.		-	.			.					*	.							
24		-			.		-	-				.		-	.	+	.	.			+	+	+						
25		.	.	.		-	*	*			.		.	.		.		.	-	+	.			.					
26						-	-	.			-			.			.		-	.		.		-					
27		.	.			.	-	.			-	.		.		.	-	.	-	-	.	.		+	.	*			
28		.	.			.	.	+	.		.			.		.	.	-	-	+	.		.	-	-	+	+		
29			-		-	-	-	-	.		.			+	.	+	+	-	+	-	.	.		-	.	+	*	+	
30				-	-				.					.							.								

6.3 CLUSTER ANALYSIS OF CLAUSE RECALL

Introduction

The purpose of this section is to go beyond contingency coefficients to investigate the relative merits of knowledge-led and text-led theorising in terms of how clauses are recalled or omitted *in groups*. It was also hoped to produce analyses that were more realistic and less prone to certain spurious effects than simple contingency analysis. The expectations from these analyses are similar to those from the contingency analyses, with clusters instead of pairs of clauses. One set of predictions about recall clustering may be taken from the groupings contained within the a *priori* structures used in passage construction (Figure 4.1), but other clusterings are possible under both knowledge- and text-led assumptions. Though the algorithm of the cluster analyses presented here is essentially very simple, it will be apparent from Section 6.1 that it goes somewhat further than previous published work along these lines.

Method

Everitt (1977) has described cluster analysis as "a loosely structured body of algorithms" used to decide how a set of items *might* be grouped together on the basis of measurements, rather than just confirming a pre-established set of groupings, ie it is exploratory rather than confirmatory. An elementary form of cluster analysis was devised using the 'simplified contingency coefficients' (SCC's) of Appendix 5.5 as data. It is best described as an example of the 'agglomerative hierarchical techniques' discussed by Everitt. Basically, each clause was assumed to belong to a *single* cluster on a basis of its SCC's with the other clauses in the cluster. Clauses were examined sequentially in order to identify strong associations with other clauses, clusters being built up a clause at a time or by the almagamation of pre-existing clusters. It was quickly recognised, however, that two factors could arbitrarily influence the pattern of clusters formed:

1. The clustering criterion adopted.

2. The order in which clauses and their associations were examined.

Three criteria for determining whether a clause or cluster should be joined with another cluster were considered:

1. The mean SCC between the prospective clause or clauses and the clauses of the cluster to be joined.

2. The mean SCC among the clauses within the new cluster *were it to be formed*.

3. The maximum single SCC between the prospective clause or clauses and any of the clauses within the cluster to be joined.

Alternative (3) was rejected because it would probably have led to rather large, rambling clusters within which many of the clauses might have little or no association with each other, thus leaving an extra problem of having to define the structure within clusters. Options (1) and (2) were not so easy to distinguish. The second seemed likely to form clusters more rapidly or clusters that were larger than those formed by the first. However, alternative (1), though promising more homogeneous clustering, might be too strict and fail to form clusters because of one or two clause associations that were low by chance. The two criteria might also produce clusters of different composition because of differences in the order in which they were constructed. It was decided to use both criteria (1) and (2) since there was little to choose between them and the computational algorithms involved were almost identical.

The order of examining clauses for cluster membership was problematic too because differences in the early membership of clusters might give rise to completely different cluster compositions later on. It was decided to make a series of complete 'passes' through the SCC matrix, using a continually decremented criterion. This criterion would be the current value of the SCC used in judging cluster formation. Initially, the criterion would be set to a value higher than any found (in fact, 0.70), and successive searches of the matrix would use values that were just 0.01 lower each time (down to 0.10). This had the advantage of ensuring that the highest SCC's dominated the initial formation of clusters, and meant that at any setting of the criterion there were very few new clause associations to be considered so that the actual order in which they were examined could make only small differences to the final clusters constructed. The final algorithm was written into a computer program (Appendix 5.7).

Results: general

Tables 6.8-6.10 give a fairly complete picture of the results of the cluster analyses on the data of Appendix 5.5. 'First' and 'second' methods refer to criteria (1) and (2) above respectively. The tables attempt to indicate the associations among clauses and clusters as a hierarchy of successively more distant or looser relations. Points along the horizontal lines indicate levels of the clustering criterion, vertical lines (parentheses) marking the values at which particular associations were formed. The key ascribes SCC's to these values, which differ for each 'method' and for each passage. The original passages, divided into clauses, are presented alongside for ease of reference.

Given the nature of the data involved, it is difficult to ascribe reliability or significance levels to particular clustering levels. Clusters formed at even quite high values of the clustering criterion may in some cases be spurious. The present author considers that little serious attention should be paid to clusters formed at values below about 0.25. This level is indicated in the tables by a vertical dotted line. The results of cluster analysis down to an SCC of 0.10 are shown, though at this level it is really the behaviour of the clustering algorithm with random data that is being demonstrated.

Immediate differences can be seen among the passages from an examination of Tables 6.8-6.10. As expected from the contingency analyses, Passages 2C and 1A show considerably less clustering than 3B at the higher levels. The groupings formed by the clauses of Passage 3B are dominated by consecutive clauses. The same trend is present but to a lesser extent in Passages 1A and 2C. The interesting feature of Passage 3B is that under the looser method of cluster formation, there are no single clauses left at the end of the clustering process.

That Tables 6.8-6.10 appear to do little more than clarify or formalise what can be seen from a careful reading of Tables 6.4-6.6 is not altogether surprising, but the cluster analyses do add greater objectivity, are able to disregard isolated contingency coefficients, can make complicated sets of interrelationships clearer, and apply a precise algorithm without distraction or error. If the data set were only a little larger, or if there were a higher proportion of high contingency coefficients, then visual inspection would be much less confident.

Comparison of the two methods of cluster formation show few differences: the second tends to form clusters at slightly higher criterion levels, and occasional clauses are classified in different clusters. On this evidence, there is little to distinguish between them, but in any future use of these techniques the first, stricter method will be employed because its algorithm gives more coherent or homogeneous clusters.

Results: clause clustering

A criterion SCC value of 0.25 will be arbitrarily chosen to discuss cluster formation: there is little justification in selecting a lower value because of the rapidly increasing risk of spurious cluster formation. The 3 passages give a total of 19 clusters at this criterion level. Detailed comments on each cluster are presented in Appendix 5.8.

Table 6.7 compares the clusters formed for each passage (Tables 6.8-6.10) with simplified groupings taken from the structural diagrams of Figure 4.1. For Passage 3B, all the later clusters have been reconstructed, though 3 out of 4 have a single clause from earlier in the passage associated with them as well. Passages 2C and 1A are not so obliging, and no clear reconstruction of the original groupings of clauses can be claimed, but then no particular theoretical value should be placed on them any way. Consecutive clauses for both of these passages do tend to be recalled together, however.

Turning to the analyses of Appendix 5.8, it appears that in the main clusters formed by the data, noncausal thematic relations are just as prominent as causal relations in all 3 passages, despite the uncertainties involved in making these judgements. Again, it is clear that many of the constituents of clusters are probably chance products. In particular, for Passage 3B there is no clear reason why single clauses from early in the passage should be members of clusters otherwise formed from later clauses.

Table 6.7: Experiments I and II: Passages 1A, 2C and 3B: comparison of observed clustering with predictions from a *priori* structures

Passage 1A

Predicted clusters:

1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-...
...-25-26-27-28-29-30

Observed clusters:

2-3-4-(15)   5-11-25   9-12-13-(14)-(15)-16   19-23-26   28-30

Passage 2C

Predicted clusters:	Observed clusters
1-3-8-12-15-16-20-22-27-28	
1-2 3-4-5-6-7 8-9-10-11	
12-13-14 16-17-18-19 20-21	11-13-14-26 6-18-19-23 20-21-25
22-23-24-25-26	
28-29-30	5-29-30

Passage 3B

Predicted clusters:	Observed clusters:
1-30 2-3-4 5-6-7-8-9 10-11-12	9-11 2-7-8-25
13-14-15-16-17 18-19-20	3-13-14-15-16-17 6-18-19-20*
21-22-23-24-25 26-27-28-29	5-21-22-23-24 26-27-28-29*
	*These groups clustered together

Discussion

While extraneous factors such as clause omission frequencies have no doubt contributed to the higher level of clustering for Passage 3B, it is tempting to suppose that its content and structure, breaking down much more obviously into (noncausal) thematically related subdivisions than the other passages, has been a major factor. This implies that the relative failure of cluster formation for Passages 1A and 2C is the result of weaker psychologically important organisation. Passage 3B is not primarily a narrative, whereas Passages 1A and 2C are, which suggests that whatever structural features may be associated with narrative passages, they are less important psychologically than other structural relations, ie than what have been broadly termed 'noncausal thematic' relations. Despite many uncertainties attaching to this data, the results of cluster analysis support a knowledge-based position.

Among the many problems of the present analyses are the following:

1. There has been insufficient numbers of clauses with moderately high omission frequencies for the easy identification of both recall contingencies and recall clusters.

2. None of the passages was deliberately constructed to exhibit the components that text-led theories would claim are important in recall; however, the Experimenter would claim that Passages 1A and 2C were nevertheless perfectly acceptable simple narratives, and less artificial than the materials favoured by, say, the story grammarians.

3. None of the passages contained 'ear-marked' causally and noncausally related material, to permit the clearest discrimination between text- and knowledge-led theorising.

Problems (2) and (3) would lead to the sort of unnatural sign-posted stories that the present research has so far avoided, but performing an investigation around passages of the kind described might help settle the relative psychological importance of the two types of relationship within discourse. This will be the purpose of Experiment V.

Table 6.8: Experiments I and II: Passage 1A: clustering of clauses based on recall contingencies

```
  First method          Second method

1-----------)        1------------)
6-----------)        6------------)-)
           .                  .   )
           .        17--------------)
           .                  .
2---------)          2--------) .
3-)-------)----)     3-)      )----)
4-)       .    )     4-)----)-) .  )
               )    15------)   .  )
8----------)--)                 .  )
21--)--------)      21--)       .  )
27--)      .        27--)-------) )
           .                  .)-)
           .        18-----)----)
           .        29-----)     .
           .                     .
5-----)   .          5-----)     .
25-----)----)       25-----)---).
11---------)        11---------)---)
           .                  .  )-)
           .        22------------) )
           .                  .    )
           .        24--------------)
           .                  .
7--------------      7------------)
           .                  . )
           .         8----------) )
           .                 .) )
9------) .           9-------)  .) )
13------)--)        13-------)) .)-)
          .)                ) .)
12----)   .)----)   12----)---)-))
16----)--)-)   )    16----)      ))
15-------).      )               )
          .     )   14----------)
17--------------)                .
          .                      .
10---------)        10-----------)
20---------)---)    20-----------)
          .   )                  .
22------------)                  .
          .                      .
14------------)                  .
24------------)                  .
          .                      .
19------) .         19-------)   .
26------)-)         26-------)-).
23--------)         23---------).
          .                      .
18-----)  .                      .
29-----)--------)                .
          .     )                .
28---)----------)   28---)       .
30---)    .         30---)       .
```

Clauses

1) One day Ernu decided to hunt the giant armadillo.
2) He went to his grandfather first
3) and borrowed some of his poison arrows,
4) then visited the village shrine
5) and prayed to his tribe's ancestral spirits.
6) After this he walked deep into the forest,
7) where he slept the night on some dry leaves in a cave.
8) Early in the morning he was wakened by a noise
9) and crept out of the cave into the moonlight.
10) At first he could see nothing except the misty river banks,
11) but eventually noticed a humped shape some way off.
12) Suddenly the shape vanished into the forest.
13) Ernu ran after it.
14) He plunged into the undergrowth, bow and arrows in hand.
15) He followed the animal's tracks for over half an hour,
16) until he came out into a swampy clearing.
17) He looked around for a while
18) before espying a shadowy depression in the undergrowth:
19) quickly he fired several arrows into it.
20) There was a loud roar.
21) He ran over
22) and found the fabulous giant armadillo,
23) but it was already quite dead.
24) Ernu jumped among the bushes
25) to skin the monster of its tough, legendary hide.
26) Then he had to drag the bulk back through the forest,
27) and after many hours reached his tribe's village.
28) He showed the hide to his grandfather,
29) who was so proud
30) that he gave Ernu a fine timber hut.

KEY: CRITERION LEVELS FOR CLUSTER FORMATION

Total hyphens & parentheses	First method	Second method
2	.48	.48
3	.46	.46
4	.45	.45
5	.40	.40
6	.35	.35
7	.31	.33
8	.30	.31
9	.26	.28
10	.24	.27
11	.23	.25
12	.21	.24
13	.18	.21
14	.14	.18
15	.13	.16
16		.14

Table 6.9: Experiments I and II: Passage 2C: clustering of clauses based on recall contingencies

```
  First method        Second method

 1-----------        1---------------
      .                   .
 3--------)          3----------)
 8--------)          8----------)
      .                   .
 4---------)              .
23---------)         9---------------
      .                   .
 9-----------        4-----------)
      .                   .   )
10-----------       10--------)  )-)
      .                   .)  ) )
11--)   .           11--)    .)--) )
14--))  .           14--))   .)    )
13---)--)           13---)-) .)    )
     )---)                 )--)    )
26------)  )        26-----) .     )
      .  )                .     )
 6----)-----)        6----)  .     )
18--)-) .           18--)-)--)     )
19--)   .           19--)    )-----)
      .                   )
      .             23-------)
      .                   .
12-----------       12---------------
      .                   .
15----------)       15-------------)
28----------)       28-------------)
      .                   .
16-----------       16---------------
      .                   .
17-----------       17---------------
      .                   .
      .              2----------)
 7----------)        7---------))-)
      .  )                . )  )
20-)    .  )        20-)     . )  )
21-)----)---)       21-)----)--)  )-)
25------)           25------).    ) )
      .                   .    ) )
27-----------       27------------) )
      .                   .      )
22-----------       22--------------)
      .                   .
 2---------)              .
24---------)        24------------)
      .                   .    )
 5-------)           5-------)----)
29-----)-)          29-----)-)
30-----).           30-----) .
```

Clauses

1) In trying to shave one morning,
2) which is always a dismal prospect before breakfast,
3) I found to my surprise,
4) on switching on,
5) that the motor made a most disturbing grating sound
6) which alarmed me at first.
7) Indeed, I had never heard its like before.
8) I took the back of the razor off
9) to look inside for anything amiss,
10) when a dozen tiny curlicues of metal fell out
11) and disappeared into the carpet.
12) I then showed the razor to a friend,
13) who knew a lot about such matters,
14) or so he let others believe.
15) He said he didn't like the look of the steel fragments,
16) and then he took the back off,
17) whereupon some pieces of charred plastic rattled to the floor,
18) alarming me even more,
19) because there couldn't have been much left inside by then.
20) But my friend placed the razor on the table,
21) where the sunlight glistened on the rust.
22) He gave me a few words of advice:
23) I should have found out long ago
24) how to use an electric razor,
25) and how to manage without the soap and razor blades
26) which had had such a deleterious effect.
27) I walked home disheartened
28) and went to have a shave in the bathroom,
29) getting out an old cut-throat with my left hand,
30) and with my right tossing the battery razor through the window.

KEY: CRITERION LEVELS FOR CLUSTER FORMATION

Total hyphens & parentheses	First method	Second method
2	.52	.52
3	.44	.44
4	.38	.39
5	.34	.35
6	.32	.32
7	.25	.29
8	.21	.25
9	.18	.24
10	.16	.23
11	.12	.18
12		.17
13		.15
14		.12
15		.11

Table 6.10: Experiments I and II: Passage 3B: clustering of clauses based on recall contingencies

```
     First method            Second method

 1-----------------       1--------------------)
                .                          .  )
10----------------)      10-----------------) )
12----------------)                        .) )
                .                          .) )
13--------------)        13--------------) .)-)
               .))                       ) .)
14-----)---------))      14-----)---------) .)
15----))        . )      15----))          )--)
16----)         . )      16----)           ) .
                . )                        ) .
 3------)---------)       3------)--------) .
17------)       .        17------)          .
                .                           .
 9-----------) .          9-----------)     .
11-----------) .         11-----------)-------)
                .                           .  )
 6-----------) .          6-------)         .  )
              )---)               )         .  )
18---)--------) . )      18---)---)------)  .  )
19-)-)          . )      19-)-)          )  .  )
20-)            . )      20-)            )  .  )
                . ))                     )---) )
26--)           . ))     26--)           )  .) )
27--)-----)     . ))     27--)--)        )  .) )
29--------)---) . ))     29-----)-----)--)  .) )
              )---))                  )     .)-)
28-----------) .  )      28-----------)     .)
                .  )                        .)
 2---------------))       2--------------)  .)
                . ))                     )---)
 7-------)      . )       7-------)      )  .
 8-------)--)-----)       8-------)-)----)  .
25----------)    .       25----------)      .
                .                           .
                .        12-------------------)
                .                           . )
 5---------------)        5----------------), )
                . )                        )--)
22-------------). )      22-------------)  ).
               )--)                   )--).
21---------)   ).        21--------)      )   .
23---------)-)-).        23--------)-)--)     .
24-----------)  .        24-----------)       .
                .                           .
 4--------------)         4-----------------)
30--------------)        30-----------------)
```

Clauses

1) It was indeed a beautiful house.
2) The decorators had tried their best with the decor;
3) each room represented a different period: [adjacent.
4) one saw classical, Georgian and ultramodern rooms imediately
5) The plumbers had installed a solid silver bath
6) and connected it to unbelievably quiet water-piping,
7) hidden from sight,
8) which was to win an important industrial award.
9) Glittering crystal taps projected from the foot of the bath.
10) The kitchen had been uniquely fitted out:
11) one wall housed a deep-freeze the size of a small room,
12) and the floor was supposedly self-cleaning.
13) The builders had taken trouble
14) to enhance the walls
15) by fusing their surfaces with oxyacetylene torches
16) so that they acquired a glass-like finish,
17) and by using blue-tinted concrete.
18) Heating was provided by large ceiling panels
19) which were no fire hazard
20) due to their low temperature.
21) The architects had chosen the site of the house,
22) and had positioned it carefully in relation to the terrain,
23) so that it nestled in its landscaping
24) as a chick snuggles in a hen's nest.
25) The site also provided the maximum protection from the elements.
26) The nurserymen had been hired from a botanical gardens,
27) and they planted many exotic shrubs,
28) distributing them in clusters
29) so as to lend an almost subtropical air to the setting.
30) Both bride and groom were overjoyed with their new home.

KEY: CRITERION LEVELS FOR CLUSTER FORMATION

Total hyphens & parentheses	First method	Second method	Total hyphens & parentheses	First method	Second method
2	.66	.66	12	.37	.37
3	.60	.60	13	.35	.35
4	.53	.55	14	.28	.33
5	.50	.50	15	.25	.30
6	.47	.48	16	.24	.28
7	.46	.46	17	.20	.26
8	.44	.44	18	.16	.25
9	.43	.42	19		.23
10	.42	.40	20		.22
11	.40	.38	21		.18

6.4 EXPERIMENT V

Introduction

The purpose of Experiment V is to resolve more clearly the differential contribution of causal structures and those based on noncausal thematic relations to the memory organisation of text. As outlined in the previous section, there was a need for experimentation with passages combining clear 'story schema' structures with easy opportunity for subjects to select other types of thematically related information. It was thought best to select a passage from the literature that had already been constructed to contain a well-defined causal structure, and to modify it to include clear noncausal thematic material.

As before, knowledge-led comprehension would predict that recall clustering should involve noncausal thematic relations as much as causal ones, whereas text-led comprehension should lead only to causally connected clauses. Taking a existing passage from the literature enabled an independent set of predictions about causally related clauses to be used. It was hoped that the modified version of this passage would permit the two possible types of clustering to be distinguished more easily than in earlier experiments.

Subjects

Subjects were 41 undergraduate students (16 male, 25 female) enrolled on psychology courses. None had previously taken part in such an experiment before.

Materials

A single passage was used in this study, heavily adapted from a story used by Thorndyke (1975a: 153), who had taken it from Rumelhart (1973). The passage, originally entitled "The Old Farmer and his Stubborn Animals", is reproduced in Appendix 1.4 and Table 6.14, together with the modified version (Passage 'F'). This passage and its description were taken to be fairly typical of the structural descriptions produced by text-led theories. The alterations to the story had three main aims:

1. To eliminate some of the abnormal stylistic features of the original story.
2. To reduce the 'starkness' of its story-line.

3. To introduce thematic elements into the passage which would be related to each other, but not in any sense causally.

Except for some curtailment towards the end, it was not intended to significantly affect the basic narrative structure of the original, so that the story-grammar analysis of Thorndyke could still be used. The actual modifications may be described as follows:

1. A curtailing of the action sequence to limit the depth to which narrative elements within the passage were nested.

2. A lengthening of many of the short and syntactically very simple clauses present originally.

3. Replacement of many of the repetitive noun phrases by pronouns and other variations.

4. Introduction of much new material, largely descriptive, but containing a few subsidiary action elements.

The resulting passage was deliberately longer than any used in Experiments I-IV, being 55 clauses and 397 words long (cf 30 clauses and 225 words previously). It included slightly more extreme values of clause length than the passages in other experiments, but the mean number of words per clause, at 7.22, was close to the earlier figure of 7.50. The greater passage length was intended to provide a greater opportunity for observing recall clustering among clauses by increasing the proportion of moderate clause omission frequencies. A partial structural description according to Thorndyke's story-grammar analysis (see Thorndyke, 1975a: 37-38) is given in Table 6.15, alongside a description of the noncausal thematic relations that were introduced.

Design

There was a single experimental condition for all subjects.

Instructions

Experiment V used a simple modification of the instructions written for the first experiment, to provide for a single passage in a single session with one reading.

Procedure

Subjects took part in the experiment in one of two group sessions in a standard classroom. Apart from the single passage and session and the consequent instructional differences, the remainder of the procedure followed that of Experiment I. The experiment was completed by all subjects within 20 minutes.

Results: general

The numbers of clauses recalled by each subject and the number of subjects recalling each clause are given in Appendix 3.6. The recall contingencies among clauses, together with Fisher exact probabilities and the raw data on which they are based are tabulated in Appendix 5.9. Tables 6.11 and 6.12 summarise data on recall contingencies (ie simplified contingency coefficients, SCC's) and omission frequencies for the clauses of Passage F, for comparison with Tables 6.1 and 6.2.

Table 6.11: Experiment V: Passage F: distribution of clause contingency coefficients

Range of values:	00-09	10-19	20-29	30-39	40-49	50-59	60-69
Number of values:	1293	124	50	11	6	1	0

Table 6.12: Experiment V: Passage F: distribution of clause omission frequencies

Number of omissions	Number of clauses
0-4	12
5-9	8
10-14	8
15-19	7
20-24	5
25-29	3
30-34	6
35-39	1
40-41	3

This comparison suggests that Passage F has sufficient numbers of moderately omitted clauses to be able to demonstrate reliable clause clustering: 23 out of 55 clauses have omission frequencies between 10 and 29, compared with 10, 10 and 18 out of 30 for Passages 1A, 2C and 3B respectively. Nevertheless, the frequency distribution of SCC's in Table 6.11 is disappointing, only 18 out of 1485 reaching a value of at least 0.30, compared with 23, 12 and 36 out of 435 for Passages 1A, 2C and 3B. Clearly with data as limited as this it was going to prove very difficult to demonstrate any reliable clustering.

Results: clause clustering

A clustering analysis was performed on the clause recall data as before, using only the 'first', slightly stricter method, and the results are presented diagrammatically in Table 6.13. The original passage is reproduced in Table 6.14 for ease of reference. One immediate feature of this data is the very small number of clusters formed at the 0.25 level, not unexpected from the frequency distribution of SCC's. The overall pattern of clustering resembles most closely that of Passage 2C, the worst in the Section 6.3.

A qualitative examination of this data for possible reasons behind the few clusters actually found is reported in Appendix 5.10. Overall, there were several likely spurious relations, and a number of associations between adjacent pairs of clauses. From this very sparse evidence, it appears that thematic or topical relations may be the most frequent. Table 6.15 compares the clusters actually found with two sets of predictions:

1. The clusters that might be expected from Thorndyke's own structural description (1975a: 37-38). It is assumed that his description applies to the corresponding clauses in Passage F.

2. The groupings that arise from the topically related material added during the adaptation of Thorndyke's passage, according to noncausal thematic relations alone.

Although Thorndyke appears to relate distance in memory to depth within his structural decription of the passage, it is not at all clear that other text-led theories, even if they arrived at a structure similar to Thorndyke's, would make this interpretation. No real 'depth' differences are intended by the 'noncausal thematic' clusters. In neither description have all 55 clauses been included, but the point is that Thorndyke's scheme would predict at least the first set of relations, and a knowledge-led theory would predict at least the second (causal relations are omitted because they do not distinguish easily between the two types of theory). The representation of observed clustering, consisting of groups formed at the 0.25 criterion level, *is* intended to differentiate degrees of association among clauses, however.

As can be seen from a comparison of the clusters observed with the two sets of predictions, there is no marked resemblance between actual results and either set of predictions. Occasional similarities with the thematic predictions concern just adjacent clauses and might be interpreted in other ways.

Discussion

The overall results of this experiment were very disappointing: the degree of clustering found was very low, and this appeared to have precluded clear findings for either of the two positions under investigation. The number of subjects could be criticised, but 41 is not all that much lower than the 54 for which clear results (for one passage) were obtained in Section 6.3, and by comparison with the earlier results, the frequency distribution of clause omissions was actually quite promising. Explaining these findings and comparing them with earlier results will form the basis of the Conclusions.

Table 6.13: Experiment V: Passage F: clustering of clauses based on recall contingencies

```
 1-----------------)
24-----------------)--)
                .     )
30--------------------)
                .
 2--------------------)
                .     )
35----------) .       )
            )---------)
33---------)-) .
48---)-----)   .
49---)         .
               .
 3----------------------
               .
 4------------).
54------------)--------)
               .       )
44---------------------)
               .
 5----------------------
               .
 6----------------------
               .
 7-------------)
18-------------)-------)
               .       )
14--)          .       )
16--)---------).       )
43------------)-)      )
              .)-------)
20--------------)
               .
 8------------------)
53------------------)
               .
 9--------------)
36--------------)
               .
10-)           .
12-)------)    .
17--------)---------)
               .    )
42------------------)-)
               .      )
31--------------------)

  (continued above)
```

```
11----------------)
52----------------)--)
                .    )
37-----)-------------)
38-----)        .
                .
13-----------------------
                .
15-----------------------
                .
19-----------)  .
21----)-----)-------)
32----)         .   )
                .   )
26------)       .   )
27------)----)------)
40-----------) .
                .
22-----------------)
29-----------------)
                .
23-----------------------
                .
25-------)      .
39-------)      .
                .
28-----------------------
                .
34-----------------------
                .
41-----------------------
                .
45---------------)
47---------------)
                .
46-----------------------
                .
50-----------------------
                .
51-----------------------
                .
55-----------------------
                .
                .
```

KEY: CRITERION LEVELS FOR CLUSTER FORMATION

Total hyphens & parentheses	Criterion level
2	.51
3	.45
4	.43
5	.41
6	.40
7	.37
8	.33
9	.32
10	.31
11	.30
12	.27
13	.26
14	.25
15	.23
16	.22
17	.21
18	.20
19	.14
20	.13
21	.12
22	.10

Table 6.14: Experiment V: Passage F listed with clause numbers

1	There once was a old farmer
2	who lived on a small sleepy farm in the country.
3	It was pleasant farm
4	nestling among grassy fields and wide meadows, with a shed and a greenhouse.
5	Now, this farmer owned a very stubborn donkey,
6	which passed the day
7	lazily grazing in a field behind the farm.
8	One evening the farmer was trying as usual
9	to persuade the donkey into its tumble-down wooden shed.
10	First, he pulled it,
11	but the donkey wouldn't move.
12	Then he pushed the beast,
13	but it still refused to move.
14	The farmer was an old widower
15	who had lived among these meadows and fields all his life,
16	but he found that he tired easily these days.
17	Fortunately, an idea ... occurred to him.
18	... for making the donkey enter its shed ...
19	Going round to the back of the shed,
20	he found his dog, a golden retriever of placid disposition,
21	sleeping by the greenhouse.
22	Politely, the farmer asked the dog
23	to bark loudly at the donkey
24	and try to frighten it into the shed,
25	but the dog refused.
26	Returning to the red-brick farmhouse,
27	which looked so sleepy amid its lush green fields,
28	the farmer next asked his cat, a ginger tom with a couple of war-wounds,
29	to scratch the dog;
30	he knew this would make it bark.
31	However, the cat, ... replied:
32	... also lazing in the evening sunlight, on the kitchen window-ledge, ...
33	"I would gladly scratch the dog for you
34	if only you would get me a saucer of milk first."
35	So finally, the farmer sought out his cow in the local meadow
36	and asked for some milk.
37	The light brown Jersey cow looked him in the eye
38	and nodded sympathetically:
39	this sequence of events happened every evening.
40	The cow gave the farmer the milk
41	he wanted
42	and the farmer brought the milk back to the farmhouse,
43	put it in a china saucer
44	and gave it to the cat.
45	As soon as the cat had licked up the fresh warm milk,
46	it climbed down off the window-ledge,
47	went out to the greenhouse
48	and began to scratch the dog's ear.
49	This made the dog bark so loudly
50	that the donkey took fright
51	and jumped straight into its shed.
52	The farmer bolted the door
53	and heaved another sigh of relief.
54	The cat returned to its life of leisure
55	and the farm settled down to another August night.

Table 6.15: Experiment V: Passage F: comparison of observed clustering with predictions from Thorndyke's story grammar and the noncausal thematic relations introduced

```
                                  Noncausal
    Thorndyke (modified)          thematic     Clusters observed

 1--)                              2--)
 5--)-----------------------)      3--)--)
                            )      4--)  )
 8--)                       )            )
 9--)-----------------------)     26--)--)      4------------)
                            )     27--)  )     54------------)
10--)                       )            )
11--)--------------------)  )     55--)--)      7--------------)
                         )  )                  18--------------)
12--)                    )  )      5--)
13--)--------------------)  )      6--)        10--)
                         )  )      7--)--)     12--)-----)
24--------------------)  )  )      9--)  )     17--------)
                      )  )  )            )
30-----------------)  )  )  )     52-----)     14--)
                   )  )  )  )                  16--)---------)
22--)              )  )  )--)     14--)        43------------)
23--)--)-----------)  )  )  )     15--)
25-----)           )  )  )  )     16--)--)     19----------)
                   )  )  )  )     17--)  )     21----)-----)
28--)              )  )  )  )            )     32----)
29--)------)       )  )  )  )     53-----)
          )        )  )  )  )                  25--------)
31--)     )--)     )  )  )  )     19--)        39--------)
33--)--)--)  )     )  )  )  )     20--)
34-----)     )     )  )  )  )     21--)--)     26------)
             )     )--)--)  )     22--)  )     27------)-----)
35--)        )--)  )  )     )            )     40------------)
36--)--)     )  )  )  )     )     47-----)
40-----)--)  )  )  )  )     )                  35------------)
          )  )  )  )  )     )     28--)                      )
42--)-----)--)  )--)  )     )     29--)        33---------)--)
44--)     )     )  )  )     )     31--)--)                )
          )     )  )  )     )     32--)  )     48----)----)
45--------)     )  )  )     )            )     49----)
                )  )  )     )     46-----)
48-------------)   )  )     )            )     37------)
                   )  )     )     54-----)     38------)
49-----------------)  )     )
                      )     )     37--)
50--------------------)     )     38--)
                            )     39--)
51--------------------------)
```

6.5 CONCLUSIONS

Structural relations

The main purpose of this section was to assess the relative importance in recall of noncausally thematically associations among recalled items, these being most likely to distinguish between the two general positions of text-led and knowledge-led discourse processing. If only causally-related items had been associated in recall, despite the opportunity being presented by passages for other types of relation, this would have supported a text-led theory, though the details of such a theory, would have been left for further investigation. As it was, thematic relations of a noncausal type proved to be at least as important as purely causal ones, which was taken as evidence for a knowledge-led position.

The experimental results were not very clear, unfortunately, mainly because most of the passages analysed produced few strong clause recall contingencies, and the clusters constructed on a basis of these contingencies tended to be small in size and number. One possible cause was insufficient clauses of 'moderate' omission frequencies: clauses which are nearly always either recalled or omitted are unable to give useful measures of recall association. Analysis of Passages 1A, 2C and 3B lent some support to this proposal, but the specially constructed Passage F showed the lowest clause clustering though its distribution of clause omission frequencies was quite promising. Some other explanation is needed, therefore.

The passage showing the greatest amount of clustering was 3B, the only primarily non-narrative passage among those analysed. This story would not be amenable to the sort of goal-oriented or causally based analysis favoured by story grammarians (as leading exponents of the text-led position), suggesting that text-led structures do not determine memory organisation, even on a fairly local scale. The failure of Passage F to show much clustering is then explained by its single dominant continuous story line, ie by the predominance of causally related structures over other types. Why a narrative story line should work against the formation of recall clusters is uncertain, but it would appear that the balance between causal and noncausal thematic relations intended by the adaptation of Passage F for this experiment may not have been successful.

Analyses

The two types of structural analyses reported above, contingency analysis and cluster analysis, were of an experimental nature. The simple cluster analyses in particular are capable of considerable development. There are several statistical alternatives to the contingency coefficient, though it is uncertain if any would have produced clearer patterns of results. Two slightly different algorithms for the cluster analyses were compared, though there was little to choose between them.

One assumption underlying both of them was that each clause belonged to only one cluster; this forces a simple hierarchical structure on memory which may not be at all valid. Future development of the clustering algorithms will certainly have to entertain multiple cluster membership for clauses, which can complicate algorithm construction enormously. Another aspect of the structure inherent in subjects' reproductions but omitted from the analyses is adjacency or sequentiality: if originally distant clauses tend to be recalled next to each other, or if the order of certain clauses is preserved at recall when that of others is not, this should provide us with additional information about how memory is organised and utilised.

The final experimental chapter will focus upon the qualitative analysis of clauses and the 3 recall components. It will largely be devoted to the finer details of verbatim and propositional representation, but some observations on the nature of the relations among items in the memory representation will be made.

CHAPTER SEVEN

QUALITATIVE ANALYSES

7.1 INTRODUCTION

Qualitative analysis

Qualitative analysis will be regarded here as the examination of recalled material for changes *in kind* from what was originally presented, whilst making fewer presumptions than quantitative analysis about the form the final results will take. Qualitative analysis is unusual nowadays except as anecdotal reports of secondary value (but see Marton and Wenestam, 1978). It dominated early work by Bartlett (1932), for whom it could be argued to have been both a strength and a weakness. A small amount of qualitative analysis was attempted in Chapter 4, in describing the differences between clauses that were more and less frequently recalled respectively, but simple characterisations of these differences failed to be confirmed either by independent judges or by experimental follow-up (Experiment IV).

This chapter will develop and apply some qualitative techniques of analysis to the data from Experiments I-III, especiially Experiment I because of the number and variety of its passages. These analyses will start from the units and distinctions of Chapter 4, ie clauses and words of the original passages, and the verbatim, nonverbatim and intrusive components of subjects' reproductions. Often, qualitative analysis will be supplemented by quantification of some aspects, but throughout this chapter it should be borne in mind that these findings are essentially the interpretations of the Experimenter alone, with all the risks of subjectivity that that entails.

Aims

It was concluded in Chapter 5 that the verbatim recall component was probably derived from the most accurately retained information in memory (the 'accuracy hypothesis'), and not a coding independent from the normal, propositional representation. If this is true, then close examination of the verbatim component in subjects' scripts should not reveal any preferences for certain words independently of what they stand for in the passage. Comparison with nonverbatim recall should highlight factors associated with whether and why substitution of original words and phrases occurs, perhaps which aspects of meaning tend to be lost first, which might lead to a description of the structure present within propositions.

On a slightly 'higher' level of representation, Chapter 6 presented evidence that the major factor in forming associations among items in memory is what has been called 'thematic', and that 'knowledge-led' processing appeared to be better supported by the data than the alternative 'text-led' processing. Unfortunately, the data left room for some uncertainty and no support for the knowledge-led position was forthcoming from the negative findings of Chapter 4, where attempts were made to differentiate between the more and less well recalled clauses. However, though implications for the relations among clauses had been discussed, most of the analyses confined themselves to the nature of individual clauses. A need remains, therefore, for more detailed qualitative comparisons of such clauses, which will take structural factors more into account. Certain words are also likely to have structural functions, since they are the starting point for the reference and repetition on which most thematic structure is ultimately based; as most of the analyses below take words as their unit, further evidence for the centrality of thematic relations may be obtained.

To summarise, these qualitative analyses were thought likely to contribute evidence on at least four theoretical points:

1. The nature of the verbatim recall component, and its relationship with propositions.

2. The manner in which the finer aspects of meaning are lost at recall.

3. The recall of particular words which might have structural functions.

4. Further observations on the recall and omission of clauses.

7.2 RECALL AND OMISSION OF CLAUSES

Introduction

In Chapter 4, the 50% most frequently omitted clauses from the three passages administered in both Experiments I and II were described as either 'peripheral' to the main plot, or 'redundant' in context. This did not prove to be a successful approach, but suffered from three possible limitations:

1. Half of all clauses were included in the most omitted group, despite many of them being quite well recalled. This might have obscured any trend confined to omitted clauses with high omission frequencies.

2. Only three passages were used, providing a lot of data, but of a more limited variety than need have been the case.

3. The manner of the qualitative analysis in Chapter 4 was restricted to general statements about clauses and their relationship with the passage as a whole: a more specific approach might come up with different or more substantiable results.

For this section, therefore, all scripts from Experiment I for all nine passages were used, and analysis attempted to be more detailed and more extensive than before. It was decided to choose more extreme groups of clauses on the omission data, those with omission frequencies of 0 or 1, and those with frequencies of 6 or greater (out of 18). This gave two groups of clauses, a '01' list and a '6+' list, containing 85 and 62 clauses respectively. The omission frequencies for all clauses in Experiment I are given in Appendix 5.1, and the passages, divided into clauses, are reproduced in Appendix 1.1.

Observations

The following listing attempts to summarise the detailed mass of observations in Appendix 6.1 on the differences between the '01' and '6+' groups of clauses. The tentative nature of many of these comments cannot be overstressed.

1. Several types of observation suggest that there are 2, not 3, types of passage among those used in Experiment I. Of the 9 passages, 4 appeared to have an easily identifiable plot or narrative line throughout (1A, 1B, 2A and 2C), whereas the remaining 5, by the evidence of subjects' scripts,

consisted largely or wholly of a series of poorly connected sections. Thus two ostensibly 'narrative' passages (1C and 2B) were treated as 'nodal'.

2. Recall favours clauses at the beginnings and ends of passages, probably because of the importance of these clauses to the overall structure or plot (cf Section 4.6). In addition, there is preferential recall of early clauses *whatever their nature*. In 'narrative' (ie 'linear' or 'branching') passages, or narrative components of passages, the most important events, judged subjectively, were usually very well recalled. Among more 'nodal' passages, the clauses introducing the various sections are recalled better than others in the same section.

3. Where similar objects or activities etc occurred in different clauses of the same passage, not necessarily in the same words, subjects often exhibited confusion among the instances, transposing them, for example, or switching their phrasing. Often this is associated with depressed recall for one or more of the instances, and occasionally the merging of two such items has been accompanied by the contraction or omission of intervening material. These effects are not seen when the repeating item is a main character or object for the passage.

4. Often, a clause has tended to be omitted apparently because the information it contains was much like what what might have been assumed or deduced by the reader had that clause not been present. Such 'inferable' clauses may or may not have been of overall structural importance. Two other types of frequently omitted clauses were described as 'unimportant' and 'misunderstood'.

Discussion

The apparent reclassification of passages into just two types is interesting. In 'nodal' passages, important clauses seem to be those which introduce the topics of sections, and there is some agreement with the a priori structures defined for the passages. For 'narrative' passages, importance is less easily defined with the present data. Subjective estimates of importance on a basis of this data seem to depend upon whether the omission of a given clause would significantly alter the meaning or structure of the rest of the passage. In both types of passage, clauses which introduce actors, essential background, initial purposes, or conclusions are all 'important', not unsurprising in the light of previous research.

Overall, these results are disappointing in not enabling more conclusions about structural features. One limitation that must be considered is whether the clause, in most cases a larger unit than the 'proposition', is too large for analysis, and the criterion for assessing its recall too broad. Often, it would have been useful to know which components of the longer clauses were producing the recall scores. Perhaps a unit more like the conventional proposition, despite its small size and the added problems introduced into the analysis of longer passages, would work better in structural analyses.

7.3 RECALL AND OMISSION OF WORDS

Introduction

Words are a valuable analytic unit because they offer the opportunity to examine what subjects recall in much finer detail than is permitted by clauses, and might therefore contain information about the nature of encoding in memory not otherwise obtainable. This section and the next two will utilise the word as the unit of analysis: in the case of this section, the raw data is based on the words of the original passages, whereas in the later sections the words of subjects' scripts will constitute the starting part for analysis.

To examine the recall and omission of individual words of the passages, it was necessary to compare each script in turn with the originals word by word, since the required information was not contained in the initial scoring described in Chapter 4. Words were scored by analogy with the procedure established for clauses, recall being determined whether or not it was verbatim. Because of the number of words in passages and scripts, it was only possible to perform this scoring on three of the passages (1A, 2C and 3B, as before).

Serial position

The pattern of clause omissions across serial position within passages was examined in Chapter 4 (cf Appendix 5.1). For the sake of comparison between clause and word analyses, the serial position function for words is given in the table in Appendix 6.2. Omission frequencies have been averaged over blocks of 9 adjacent words for convenience. There is little of interest in this table except to note that recall is relatively independent of serial position with two exceptions: initial and final blocks of words (paralleling the clause results), and high omission frequencies around blocks 11 and 12, which may be an unimportant coincidence.

Observations

Appendix 6.3 shows the most and least frequently omitted words for each of the three passages, in the form of 'half-passages' after the style of Appendix 5.4 for clauses; words least often omitted are in capitals. Apart from the serial position effect, there seems to be a tendency for adjacent words to have similar omission scores, ie words tend to be recalled or omitted *in phrases*. To investigate this further, a runs test as performed on each passage, using the differentiation into high and low omission clauses of Appendix 6.3. Table 7.1 summarises the results of the tests, which were highly significant for each passage, ie there are fewer and longer runs of the words of the same classification than would be expected by chance.

<u>Table 7.1 : Experiment I: Passages 1A, 2C and 3B:</u>
<u>runs tests on overall word recall data</u>

Passage	n1	n2	r	z	2-tailed p
1A	110	115	79	-4.55	0.00001
2C	115	110	59	-7.27	<<0.00001
3B	122	102	69	-5.82	<0.00001

As with clauses, it was decided to adopt two approaches to the qualitative analysis of word omissions: contrasting the top and bottom 50% of words (Appendix 6.3), or contrasting only the extreme groups of words (Appendix 6.4). From an examination of these classifications the Experimenter felt he could see the following, but without great confidence:

1. The preferential omission of adjectives and adverbs.

2. The preferential recall of verbs.

3. The preferential recall of major actors and objects (all nouns).

4. The preferential recall of the definite article, often in isolation.

Observation (4) probably reflects the application of the scoring criteria, but the others merit further investigation, and it was decided to clarify them by an analysis of the recall of the parts of speech of each of the three passages.

Complete lists of nouns, verbs, adjectives and adverbs for each of passages 1A, 2C and 3B are given in Appendix 6.5. Table 7.2 shows the frequencies with which each of these four parts of speech, and 'others' (conjunctions, pronouns, prepositions and articles) was recalled. Chi-square tests were performed on each table entry (as explained in the table), comparing the distribution of each type of word across high and low omission word groups, with the distribution of *all other words* from the same passage. Several of the comparisons in the table were significant:

1. For Passage 1A, verbs were favoured in recall.

2. For Passage 2C, adverbs were preferentially omitted.

3. For Passage 3B, there was a marginally significant preference for nouns in recall.

4. Overall, there were marginally significant trends for both mnouns and verbs to be recalled, and a highly significant trend for adverbs to be omitted.

5. 'Other' parts of speech were on the whole less well recalled.

The main findings are the poor recall of adverbs, and the good recall of nouns and verbs, but in a manner that varies across passages. The suggestion from these passages is that verbs might be particularly well recalled in narrative passages, and nouns in nodal ones, Passage 2C giving intermediate results (perhaps correspondng to its intermediate structure).

The more extreme groupings of words (Appendix 6.4) adds little to previous analyses. Many of the best recalled words belong to the best recalled clauses, and so for the worst recalled words. The Experimenter did suspect, however, that many of the best recalled words, particularly in Passage 3B, were words that were intrinsically more memorable, perhaps because of the imagery they encouraged (eg 'silver bath', 'crystal taps', 'nestled', 'chick').

Discussion

Many of the findings with words only confirm what had aready been established with clauses, though some new findings have emerged. Units of recall larger than the word do exist, but this does not detract from the utility of the word as an analytic unit. Less clearly, the preferential recall of nouns and verbs in narrative and nodal passages respectively suggests that these words reflect different organising principles brought to different passages by subjects.

Table 7.2 : Experiment I: Passages 1A, 2C and 3B: frequencies of low overall omission for different parts of speech

Passage	Nouns	Verbs	Adjectives	Adverbs	Others	All words (+)
1A	25/50= 50%	23/31= 74%**	11/25= 44%	3/12= 25%	48/108= 44%	110/225= 49%
2C	25/44= 57%	24/38= 63%	15/21= 71%	2/14= 14%**	49/114= 43%	115/225= 51%
3B	39/57= 68%*	17/33= 52%	21/34= 62%	4/9= 44%	41/95= 43%*	122/224= 54%
ALL	89/151= 59%*	64/102= 63%*	47/80= 59%	9/35= 26%***	138/317= 44%**	347/674= 51%

(+) sums of numerators under headings are more than the total number of words because several words have been classified under two headings

* p<0.05) results of chi-square
** p<0.01) tests (see text)
*** p<0.001)

KEY TO CELL CONTENTS:

number of words in low omission / total number of such words

23 / 31 =

74%

percentage equivalent of ratio

Sample contingency table: Passage 1A: verbs

	verbs	all other words	all words
no. in low omission category	23	87	110
no. in high omission category	8	107	115
all such words	31	194	225

On above table: X2 = 8.076, df = 1, p < 0.01

7.4 VERBATIM RECALL

Introduction

Verbatim recall is defined here as that part of subjects' story reproductions that is in the original words; in Chapter 4 it was one of three recall components into which subjects' scripts were divided. This section aims to examine the actual words scored verbatim in order to elucidate the factors determining verabtim as opposed to nonverbatim recall, and to clarify the relation between verbatim recall and the propositional level of representation. As before, the analyses will be restricted to the recall of Passages 1A, 2C and 3B from Experiment I.

Near-verbatim recall

The verbatim scoring criteria of Chapter 4 were strict in not scoring 'verbatim' those words in subjects' scripts that were part of or simply derived from (usually morphemically related to) an original word. During the application of the scoring criteria, it became apparent that these variants had more in common with verbatim than the nonverbatim recall with which they had been scored. Many appeared to be verbatim recall which subjects had had to modify to fit the immediate verbal or syntactic context. All instances of near verbatim recall for Passages 1A, 2C and 3B are given in Appendix 6.6. Most of these are changes in tense or number, or to a derived form of another part of speech, but a small number represent the fragmentation of an original word. In all subsequent qualitative analyses, near-verbatim material will be classified with verbatim instead of nonverbatim. In fact, of the redefined verbatim component, only 6.3% is near-verbatim (Passage 1A, 6.1%; 2C, 6.2%; 3B, 6.7%).

Observations

Basing an analysis of verbatim recall on frequency data alone would confound the overall and verbatim recall of words. To avoid this, a new measure, 'verbatim tendency' was be defined as the *proportion* of recalled instances of a word that are scored verbatim (including near-verbatim). Words with zero overall recall were arbitrarily assigned a verbatim tendency of zero. Appendix 6.7 displays data for the mean verbatim recall tendency of words against overall recall frequency. The appearance of a small positive correlation between verbatim tendency and overall recall is tested out in

Table 7.3, confirming this for one passage only (3B).

Table 7.3: Experiment I: Passages 1A, 2C and 3B: Spearman rank correlations between overall recall frequency and mean verbatim tendency

Passage	N*	r_s	2-tailed p
1A	17	+0.433	n.s.
2C	18	+0.096	n.s.
3B	17	+0.827	<0.001
ALL	18	+0.499	<0.05

Appendix 6.8 shows for each of the three passages the 50% or so of words with verbatim tendencies higher or lower than the median (about 0.8). Two trends suggested themselves to the Experimenter: for phrases to be recalled as verbatim units, and for words in early or late clauses to be recalled verbatim; both suspicions could be tested. Firstly, runs tests performed on the Appendix 6.8 data are presented in Table 7.4. For Passages 1A and 2C, but not 3B, there is a significant tendency for words of high or low verbatim tendency to cluster together, though from the actual number of runs involved, the trend is not as pronounced as with the overall recall of words (Table 7.1). The relationship between serial position and verbatim tendency is demonstrated in Appendix 6.9, but there is no trend there worthy of further analysis. The high value for the beginning of 1A appears to be an isolated example, perhaps of unusually predictable phrasing (ie a cliche).

Table 7.4: Experiment I: Passages 1A, 2C and 3B: runs tests on verbatim tendency data

Passage	n1	n2	r	z	2-tailed p
1A	137	88	83	-3.54	0.00039
2C	115	110	92	-2.86	0.0043
3B	104	120	107	-0.795	0.427

Further examination of Appendix 6.8 indicated that differences in verbatim tendency might exist for different parts of speech, verbs scoring particularly low. An analysis was therefore performed as for overall recall, with the results in Table 7.5. Apart from verbs, no significant effects were found, with the small exception of 'other' parts of speech in the pooled data. The effect for verbs, however, was highly significant: only 29% of of all verbs were in the high verbatim category, compared with an overall mean of 53%. This susceptibility of verbs to nonverbatim change will be explored further in the next section.

Table 7.5: Experiment I: Passages 1A, 2C and 3B: frequencies of low verbatim tendency for different parts of speech

Passage	Nouns	Verbs	Adject-ives	Adverbs	Others	All words (+)
1A	33/50= 66%	11/31= 35%**	15/25= 60%	6/12= 50%	72/108= 67%	137/225= 61%
2C	26/44= 59%	12/38= 32%*	8/21= 38%	7/14= 50%	62/114= 54%	115/225= 51%
3B	29/57= 51%	7/33= 21%	20/34= 59%	1/9= 11%	47/95= 49%	104/224= 46%
ALL	88/151= 58%	30/102= 29%***	43/80= 54%	14/35= 40%	181/317= 57%**	356/674= 53%

(+) Sums of numerators under headings are more than the total number of words because several words have been classified under two headings.

* p<0.05) results of chi-square
** p<0.01) tests (see text)
*** p<0.001)

KEY: See Table 7.2 for further explanation

Extreme groups of words on verbatim tendency are shown in Appendix 6.10, but again there are few obvious differences between the two sets of words, except for a suspicion that high verbatim tendency words include more that are structurally imprtant to the passage. Taking Appendices 6.8 and 6.10 together, the Experimenter felt that he could describe high verbatim tendency words very often as:

1. Words for which few or no synonyms exist (eg articles, some nouns, and many prepositions).

2. Words for which synonyms do exist, but for which substitution would have altered the meaning of the passage (eg many nouns, some verbs).

3. Occasionally, words for which acceptable synonyms exist, but which were somehow noteworthy or memorable in themselves, perhaps by being unusual in their context, or vivid in their associations.

In general, it seemed that high verbatim tendency words were ones which were under some constraint *not* to undergo change, though this is difficult to demonstrate at all objectively.

Discussion

After broadening the scope of verbatim recall slightly and defining 'verbatim tendency', a number of differences were described between words of high and low verbatim tendency. In general, it seemed that words tended to be recalled verbatim when they were constrained not to be recalled nonverbatim. More clearly, verbs were recalled verbatim rather less frequently than other words, and this might be due to the relative absence of constraints on them at recall. Any influence on verbatim recall of passage structure is probably minimal. It is hoped that the tentative nature of the present findings will be improved after the analysis of nonverbatim recall.

7.5 NONVERBATIM RECALL

Introduction

In many ways, nonverbatim recall is the converse of verbatim recall: that which is recalled, but which is not verbatim, must be nonverbatim. Thus many of the conclusions about verbatim recall apply with simple modification to nonverbatim recall, including the findings about verbs and the constraints against change. By analysing nonverbatim recall, it was hoped to clarify the factors predisposing to verbatim recall, and also to examine the sort of information detail or loss represented in the 'propositional' level of encoding.

Observations

To avoid spurious substitutions and facilitate the identification of reliable trends, it was decided to restrict analyses to words of high nonverbatim recall frequency. All words recalled nonverbatim by at least 8 subjects and their nonverbatim forms (substitutions), for Passages 1A, 2C and 3B, are set out in Appendix 6.11. Table 7.6 summarises this data by listing from the appendix all substitutions found 4 or more times, slightly simplified, together with their natural frequencies from the Thorndike-Lorge norms (explained below).

The Experimenter's main observations on the data of Appendix 6.11 are as follows:

1. The susceptibility of verbs to nonverbatim recall was confirmed. Often recall was dominated by one much commoner word: eg 'goes/went' for 'walked', 'ran' or 'visited'. Such substitutions often entailed some loss of meaning, eg of the manner of motion.

2. A few verbs, and some descriptions of emotion, were recalled with a considerable proliferation of substituted forms. Often, confusion or contextual changes were involved. In the case of 'emotions' (eg surprise, superlatives), the use of different words within the passage and the wide availability of near-synonyms within the language seemed to be the cause.

3. Nouns showed simpler recall behaviour than verbs. Substitutes tended to consist of near-synonyms, equivalent referents (eg 'animal' for 'shape'), or of pronouns. Again, nonverbatim forms were often simpler and commoner than the original words.

4. Prepositions, conjunctions and adverbs often changed to near-synonyms or altered in response to local phrasing.

5. There was the frequent suspicion that the occurrence of similar material elsewhere in a passage had influenced the words used for an item.

In general, three factors were identified as particularly influential in determining verbatim or nonverbatim recall and the actual forms substituted:

1. Context: the immediate phrase, similar material elsewhere, even the passage as a whole.

2. The availability of synonyms in the English language.

3. Natural word frequency: especially for verbs, it was felt that substitutes were commoner words, with more general meanings.

The effects of context can only be demonstrated here by the examples of Appendix 6.11. Synonym availability is difficult to assess because word frequency norms do not give classification by meaning; careful use of sources such as Roget (1953) might be helpful, but its organisation raises practical problems. Word frequency analyses are easier to perform, though the published norms (eg Thorndike and Lorge, 1944; Kucera and Francis, 1967) take no account of common phrases or of the different meanings words may have.

<u>Word frequency</u>

Following up a suggestion from the qualitative examination of nonverbatim recall, it was thought desirable to investigate the natural frequencies of original words and their substitutes. All the words in the summary data in Table 7.6 have their frequencies of usage from the Thorndike-Lorge listings entered beside them. These frequencies are expressed as occurrences per million words of text. Where the norms have A or AA ratings, representing 50-99 and 100 or more per million respectively, a numerical estimate has been derived from the components of the overall frequency estimate or from the partial data of Thorndike and Lorge's Part IV. Data has been combined in the few cases where the counts list, say, tenses separately: normally the norms would combine these.

After eliminating phrases (difficult to analyse) and pronouns (a special kind of substitution), there were 37 pairings of original and substitute words in Table 7.6. In 28 of these, the substitute has the higher natural frequency, and this pattern is significant by a sign test ($p < 0.01$). It can be concluded, therefore, that when a word is recalled nonverbatim, its major substitutes will tend to be commoner words. Whether this is because of frequency or familiarity alone or because these words tend to have more general, less constrained meanings cannot yet be determined.

Discussion

There is confirmation from the analysis of nonverbatim recall for the conclusions reached with verbatim recall, that changes in wording occur on recall when there are no factors specifically preventing them. The constraints controlling *both* verbatim and nonverbatim recall appear to comprise:

1. Contextual factors at a number of different levels.
2. Lexical factors: eg the availability of synonyms or near-synonyms, and the natural frequency of occurrence of words.

On the surface, these results further support the 'accuracy' interpretation of verbatim recall favoured in Chapter 5, in that there is no evidence for an independent verbatim memory in parallel with propositional encoding. The same factors can be sen to influence verbatim as nonverbatim recall, implying that the same underlying structures and processes are involved. Closer inspection of the data, however, suggests that accuracy of memory may not even be the main factor distinguishing verbatim from nonverbatim recall, and that extraneous influences such as the availability of words in the English language determine the final wording used, though it would be very surprising if accuracy differences did not also play a part.

Table 7.6: Experiment I: Passages 1A, 2C and 3B: summary of major instances of nonverbatim recall

Frequencies in parentheses; * indicates data omitted from tests

Pass	Original word	Substitute(s)
1A	walked (321)	went (4678)
	monster (20)	it (12711) *
	and (30816)	to (25635)
	visited(178)	went/goes (4678)
	espying (4)	saw (1903); noticed/-ing (155)
	vanished (39)	disappearing etc (61)
	noticed (155)	saw/seeing (1903)
	after this (1234/3913)	then (1904) *
	ran (509)	went/going (4678)
	shape (114)	which (3413) *
	borrowed (48)	get/got (2471)
	Ernu (0)	he (20827) *
	animal's (146)	it/its (12711) *
2C	let (616)	led (389)
	walked (321)	went (4678)
	matters (362)	things (1095)
	rattled (28)	fell (387)
	tossing (46)	throwing/threw (216)
	manage (73)	use/using (919)
	through (931)	out of (2133/25523) *
	whereupon (13)	and (30816)
	sound (271)	noise (82)
	some (1343)	several (261)
	showed (624)	took (1848)
	to (26535)	out (2133)
	found (968)	hear/heard (592)
	gave...words (1246/542)	said (3462) * ; told (1121) *
	found out (968/2133)	learned/learnt (291) *
	when (2725)	and (30816)
	took off (1848/644)	opened/opening (388) *
	then (1904)	this time (3913/1898) *
	placed (855)	put (553)
	motor (59)	razor (7)
	my friend (21412/567)	he (20827) *
3B	overjoyed (3)	happy (221); pleased (184); delighted (101)
	acquired (46)	give/given (1246)
	so that (2655/12054)	to (25635) *
	tried (557)	taken (1848)
	housed (758)	was (34466)
	lend (54)	give etc (1246)
	nurserymen (0.8)	gardeners (15)
	best (419)	care (515)
	as (6812)	like (1552)
	installed (16)	fitted (139)
	due to (111/25635)	because (725) *
	shrubs (17)	plants (222)
	from (3719)	at (5833)
	had been (14986/35704)	was (35704) *

7.6 INTRUSIONS

Introduction

In all the experiments, intrusive recall was much the smallest component. The main issues for the qualitative analysis of intrusions are their relationship with nonverbatim recall (ie whether it is really best described as intrusive), and what they can tell us about the encoding of information from text. As a supplement to the results of Experiments II and III of Chapter 5, it was considered that intrusive recall might highlight differences among experimental conditions more clearly than the other recall components. First, some qualitative observations will be made on the intrusions from Passages 1A, 2C and 3B in Experiment I.

Observations on Experiment I

Among the intrusive recall component defined in Chapter 4 were a number of 'trivial' words, ie particles that were either isolated words or parts of otherwise non-intrusive phrases; these averaged 1.5 to 2 words per script and have been omitted from the present analyses because they were thought more likely to reflect the scoring criteria than the nature of the information recalled.

The most notable intrusions from Experiment I, ie those given by 2 or more subjects or which were phrases of 5 or more words, are listed in Apendix 6.12. Most seem to be deductions or inferences of the sort the author might have had in mind or which an average reader might be expected to make. The Experimenter felt he could distinguish 5 intrusion types, based on the departure from the original information each represented:

1. Expansions of original wording with little change in meaning or extra information.

2. Material inferred predictably from the immediate context to produce additional but unimportant information.

3. Material inferred predictably from elsewhere in the passage, frequently including repetition of words from another clause.

4. Less trivial inferences, consistent with the original passage, but not so predictable nor necessarily intended by the author. These often utilised information from outside the passage.

5. Additions, usually consistent with the rest of the passage *as recalled*, which could not be called 'inferences'. These tended to include fairly novel material introduced by single subjects and occasionally would have conflicted with aspects of the passage not recalled.

It is quite conceivable that more radical intrusions might have been produced by subjects, but none were found.

Most intrusions were obtained from single subjects, but a number found more than once are listed in Appendix 6.12, each being followed by its 'type' from the scheme above. Type (iv) were rare and type (v) absent from this set, and few were phrases of longer than two words. All intrusive phrases of 5 or more words in length are also given in Appendix 6.12, again with their recall types. Out of 25 such phrases, 5 or 6 are of type (v); one of these is a justification for an original event, the remainder describe things did not or might not have occurred among the events recounted. Referring back to the original scripts, all of this small group seem to be associated with poor recall of their immediate context.

<u>Observations on Experiments II and III</u>

Both Experiments II and III manipulated the conditions of recall in ways that were found to influence, *inter alia*, the number of intrusions in subjects' reproductions. It might reasonably be expected that qualitative examination of these effects would throw light on the structures and processes mediating intrusive recall. Appendices 6.13 and 6.15 give all intrusions of 5 words or more for the two Experiments, the former also shows all intrusions for Experiment II produced by two or more subjects.

The intrusions for Experiment II reveal little that is new, having the character of those described for Experiment I. Although there were more intrusions of types (iv) and (v), or of 5 or more words in length, under Liberal instructions, neither trend is noteworthy because all intrusions increased for this condition (Table 7.7). Kruskal-Wallis one-way nonparametric anovas (Table 7.8, based on the raw data of Appendix 6.14) were marginally significant for two passages in the case of type (iv) and (v) intrusions and for one passage in the case of longer intrusions, but these refer to absolute frequencies not proportions and are probably of little consequence.

Table 7.7: Experiment II: numbers of intrusions by type and length

Pass-age	Cond-ition	Intrusion type i-iii	Intrusion type iv no's	Intrusion type iv %	Length in words 1-4	5 or more no's	5 or more %
(	P	44	8	15.4	47	5	9.6
1A (	N	46	6	11.5	44	8	15.4
(	L	61	18	22.9	71	7	9.0
(	P	53	9	14.5	58	4	6.5
2C (	N	70	8	10.3	75	3	3.8
(	L	108	19	15.0	116	11	9.5
(	P	42	5	10.6	42	5	10.6
3B (	N	62	5	7.5	64	4	5.9
(	L	77	9	10.5	78	8	9.3
(	P	139	22	13.7	147	14	8.7
ALL (	N	178	19	9.6	183	14	7.1
(	L	246	46	15.7	266	26	8.9

Table 7.8: Experiment II: comparison of passages across conditions on types and lengths of intrusions

Intrusions		Passage 1A	2C	3B	ALL
Types (iv) & (v)	(H*	8.315	6.155	1.257	8.524
	(p	<0.02	<0.05	n.s.	<0.02
5 or more words	(H*	0.894	7.900	0.649	1.916
	(p	n.s.	<0.02	n.s.	n.s.

* Kruskal-Wallis tests: n1 = n2 = n3 = 12, df = 2

In Experiment III, more intrusions were found in the two delayed conditions, particularly without first session recall (ie 2N), than in immediate recall. This was tentatively ascribed to subjects' varying their recall criteria in response to more demanding conditions. This explanation would predict an increase in the longer and more extreme kinds of intrusions, as a proportion of all intrusions, and this can be tested directly. Table 7.9 shows the numbers of the various types of intrusions for each passage and condition, and the expected proportional increases do occur. Nonparametric tests (Table 7.10, based on Appendix 6.16) on the absolute frequencies indicated significant differences, mainly in the comparison of sessions 1 and 2N; as before, the differences appear mostly when comparing first session recall with delayed first recall, which was the only comparison to produce a significant difference in Chapter 5.

<u>Table 7.9: Experiment III: numbers of intrusions by type and length</u>

		----Intrusion type----			--Length in words--		
Pass-	Cond-		----iv-----			5 or more	
age	ition	i-iii	no's	%	1-4	no's	%
	(1	135	5	3.6	122	18	12.9
S	(2R	134	13	8.8	122	25	17.0
	(2N	145	20	12.1	110	55	33.3
	(1	153	10	6.1	143	20	12.3
T	(2R	146	13	8.2	136	23	14.5
	(2N	92	31	25.2	91	32	26.0
	(1	288	15	5.0	265	38	12.5
BOTH	(2R	280	26	8.5	258	48	15.7
	(2N	237	51	17.7	201	87	30.2

The delayed first recall condition (2N) of Experiment III revealed more and longer intrusions of types (iv) and (v) than anywhere else in the present study, and these are reproduced in Appendix 6.15. Inspection of the appendix shows up a number of elaborate inventions, again not seen previously, suggesting that the unusual difficulty of the task had encouraged some subjects not to take as seriously as they might. This is the only evidence in the present study for Gauld and Stephenson's (1967) contention that the inaccuracies of recall which Bartlett (1932) and others have used to support the idea that recall is constructive, are due to subjects' deliberately inventing material through a lack of 'conscientiousness'.

Table 7.10: Experiment III: comparison of passages across conditions on types and lengths of intrusions

Passage	Intrusions	Session: 1 and 2R *	Session: 1 and 2N **	Session: 2R and 2N **
S	types (iv) and (v)	T=3, n=7 p<0.05	U=73 p<0.01	U=97 p=n.s.
S	5 or more words	T=25, n=12 p=n.s.	U=57 p<0.005	U=106 p=n.s.
T	types (iv) and (v)	T=6, n=6 p=n.s.	U=72 p<0.02	U=79 p<0.05
T	5 or more words	T=16.5, n=9 p=n.s.	U=105 p=n.s.	U=112 p=n.s.

* Wilcoxon 'T'

** Mann-Whitney 'U', n1 = n2 = 16

Discussion

Intrusions are not only a small component in recall, but an unremarkable component too. Most are inferential in some way, better described as changes in original material than as additions of new material. With few exceptions, therefore, intrusions are best regarded as no more than an extreme form of nonverbatim recall. The character of intrusions did not alter across the conditions of Experiment II, though there number had significantly increased (Chapter 5). A sharp change had occurred, however, in the nature of intrusions from the delayed first recall condition (2N) of Experiment III, supporting the notion that subjects use a recall criterion to edit what they can remember.

7.7 CONCLUSIONS

Memory encoding

From these analyses it seems that, but for a few exceptional instances, there is no verbatim component in the long-term memory representation of text, which is consistent with earlier findings. Verbatim recall is the product of a memory code of reasonable accuracy together with a host of lexical and contextual constraints. In the case of common words being used originally, the response bias that appears to exist towards such words, would be expected to enhance their accurate reproduction.

If these conclusions are reliable, doubt must even be cast on the accuracy of the representation from which verbatim recall is constructed. It would seemingly be less detailed than some authors have assumed because accuracy of this representation alone is not a guarantee of verbatim recall. If intrusions are mostly just an extreme form of nonverbatim recall, they must be the product of a considerably impoverished memory encoding which, with the nonverbatim results themselves, implies either that there is no distinctive 'propositional' level of encoding, or that propositions are capable of continuous degradation of the information they contain. One difficulty in investigating the details of the memory representation is that the free recall paradigm produces material that has already been considerably 'reconstructed' or edited and may no longer be a close reflection of the underlying representation.

Structural relations

From the pattern of omissions and confusions in subjects' recall, it looked as though they were reacting to two types of passage structure: narrative and nodal. These cut across the passage types that had originally been constructed. In this sense, 'narrative' passages possess a continuously linked story-line consisting largely of causal relations, whereas 'nodal' passages break down into discrete sections, each thematically distinct, with little causal connection between them. Two passages (1C and 2B) constructed as narrative were treated as nodal by subjects who appeared unable to identify the story-line intended by the Experimenter. This corresponds to the distinction hinted at in the last chapter between passages based on identifiable segments which may be clustered on recall, and those structured mainly from causal relations which do not demonstrate clustering.

Subjectively judged key events were best recalled in narratives, and clauses introducing individual sections were favoured in nodal passages; clauses introducing actors and setting were well recalled in most passages.

There was some indication from the pattern of recall of individual words that nouns might be better remembered in nodal passages, and verbs in narratives. This makes sense if the latter are organised around causal or action sequences and the former around a series of topics which may as easily be people or objects as actions.

Methodology

Two methodological implications arise from this chapter:

1. However useful they might be analytically, the word-based recall components have no theoretical validity: all three seem adequately explained as the products of the same recall processes.

2. While the clause may be convenient, some problems may have come from its being a large unit, much discussion centering on the behaviour of *parts* of clauses; the word analyses certainly support phrases as realistic units. To what extent there is division like the 'proposition' at work cannot be judged at the moment.

Finally, despite its unavoidable subjectivity, qualitative analysis has proven useful. The main problems encountered have been the length of time necessary for some of the analyses, and the limitations of available norms on synonym availability and word frequency.

CHAPTER EIGHT

DISCUSSION AND CONCLUSIONS

8.1 INTRODUCTION

The main purpose of this Thesis has been to investigate some ideas about the nature of the memory representation formed from certain types of text, the two central issues being the nature of the encoding used and the structural interrelations among items in memory. The results from a number of studies have been spread over several chapters. This chapter will attempt to integrate these findings together and explore some of their implications for discourse memory and for the processing activities that take place during comprehension.

8.2 TEXT ENCODING

The unit of encoding

Memory researchers have for long assumed that there exists a tidy unit from which memory representations of any complexity are constructed. There are two reasons for this: it makes theory and model building much easier, and there is limited evidence that the 'proposition' is psychologically real. Evidence for the reality of propositions derives from two sources: work with small numbers of sentences, and discourse research using models in which the proposition has a special predefined status (see Chapter 1 and Section 3.2). The research reported here did not set out to verify the reality of the proposition directly; it was accorded no special prior status and was not employed as an analytic unit. Nevertheless, a 'propositional' level of representation was recognised, and many findings were intended to indicate the nature of the information held in memory at this level.

Quite often in the qualitative clause analyses of Section 7.2, observations were being made on *parts* of clauses as well as whole clauses: a need was often felt to discover which component of a clause had contributed to its recall. Elsewhere, runs tests on word recall (Section 7.3) found that runs of words (ie phrases) were frequently recalled or omitted as a unit. Together, these observations suggest that there does exist a natural processing unit much like the conventional 'proposition' in size.

However, both the word and the clause were found to be useful analytically, and there is evidence to suggest that either or both might approximate to theoretically meaningful units too. The relationship between clause length (and very roughly the number of contained propositions) and recall was quite poor despite large variations in clause length, which might not have been the case had the proposition been the real unit of processing. In the analyses based on words, many features such as the type of forgetting which occurred (evidenced by the nature of nonverbatim substitutions) implied that units of meaning rather smaller than the proposition were being observed. Thus there is some evidence that units both smaller and larger than the proposition may have psychological reality.

From an analytic point of view, there are advantages in employing units covering a spread of sizes: clauses for structural investigations, words for studying finer aspects of meaning, perhaps propositions for structural investigations where the clause is too large. The psychological reality of those units cannot be finally decided here: all that can be said with any certainty is that no single level of analysis stands out above the others as having greater theoretical validity.

Verbatim recall

Whatever material subjects managed to reproduce from a passage in the original words was termed 'verbatim recall'. Two separate theories of the production of this component were termed the 'accuracy' and 'parallel' hypotheses, according to whether verbatim recall is due to accurate reproduction from a single underlying memory representation, or to a specifically verbatim form of encoding, independent of any semantically based representation. Recent arguments in the literature for the parallel hypothesis (eg Anderson and Paulson, 1977; Hayes-Roth and Hayes-Roth, 1977) have been isolated, but little evidence to the contrary has been proposed. It was therefore considered important to clarify the nature of verbatim recall. If verbatim recall were an independent form of encoding, this would complicate our understanding of the processes underlying all text recall; if it were simply a reflection of the more accurate aspects of a single form of encoding, studying verbatim recall might tell us something about the fine structure of that representation and how it alters over time.

The initial results from Experiment I showed no particular support for either position; the curious variation of verbatim recall across passages was consistent with the accuracy hypothesis only if passages differed in the ease with which they were recalled at the level of fine detail. Verbatim recall was the only component to vary noticeably across subjects and order of presentation, both effects being equally consistent with either hypothesis. A comparison with the data of Experiment II led to the conclusion that reading a passage a second time substantially increased the verbatim component, again consistent with either position.

Experiment II showed that altering the recall instructions given to subjects altered the amount of nonverbatim, but not verbatim material recalled. Experiment III found that delaying recall, especially first recall, affected the verbatim component far more than it did nonverbatim recall, and that recall after an interval was considerably better with prior immediate recall, mainly as a result of improvements in the verbatim component. Together, these findings suggested that verbatim recall was simply more accurate information which was recognised as such by subjects, and was lost more quickly than other information. This evidence is by no means conclusive, however, and a parallel interpretation could still be made to fit the data.

An alternative line of evidence supporting the accuracy hypothesis was provided by the qualitative analyses of Chapter 7. In analysing both verbatim and nonverbatim recall it was discovered that two principle factors determined whether material was recalled in the original words or not: contextual constraints such as surrounding phrases or words used previously for particular items, and the availability of suitable alternatives in the language. Not only were the same processes apparently in use for both components, but there was little evidence from these analyses that accuracy was a major factor in verbatim recall, though it is probable that the analyses were fairly insensitive to accuracy of representation.

In summary, it appears that the propositional level of representation contains little directly verbatim (or lexical) information, and that there is no important verbatim encoding of information separate from the semantic representation. The involvement of purely verbatim memory cannot be ruled out entirely: Appendices 6.8 and 6.10, as well as subjects' individual scripts, contain many examples of isolated words being reproduced exactly, and nonverbatim recall (eg Appendix 6.11) shows examples of substitutions being words found elsewhere in a passage. Such instances are a small proportion of all recalled material, however.

The structure of propositions

It is not usually denied that propositions have internal structure: the question is whether this detail plays an active part in discourse memory and the traditional answer has been that it hasn't, but the limitations on previous research justify further enquiry. From the results discussed so far, two inferences may be made about the internal structure or detail of propositions:

1. In general, the propositional level of representation does not normally contain sufficient information for the reconstruction of the original wording of discourse: if this is achieved it is by a combination of factors only one of which is repreentational accuracy.

2. The memory representation appears to consist of a series of levels or a continuum of encoded detail; there is no evidence in the present study that there is anything special about the level traditionally represented by propositions, or that propositions behave in a discrete fashion in memory.

This further confirms that the term 'propositional representation' is most usefully applied to the most detailed level of semantic encoding in memory, and that a 'proposition' may be no more than a handy analytic unit.

The best evidence from the qualitative analyses about the detail contained at the propositional level of encoding comes from the analysis of substitutions for original words. Substitutes were mostly words of higher natural frequency and broader meaning. Though stylistic conventions about the vocabulary used in story telling may have influenced these results, the replacement of specific words by more general words strongly suggests that a loss of detail from memory has occurred. For example, the best a subject can recall from an original item "beast" may be "animal", or from "ran", "went". In fact, verbs were more susceptible to nonverbatim recall than other parts of speech, and were particularly prone to this type of substitution.

Another source of evidence about the detail present in the memory representation comes from the analysis of intrusions. On the whole, intrusions in all the experiments were an unremarkable collection, most having the character of inferences, and were better described as inaccurate recall of original information than as the addition of genuinely new information. Hardly any were inconsistent with the original stories. The only change in the actual character of intrusions came with delayed first recall in Experiment III, arguably the most difficult recall situation of all.

Thus, the propositional level of representation contains fine detail that plays an active part in memory, and may at times be sufficiently general to permit a range of inferential recollections that have been inaccurately called 'intrusions'. The first supports the idea of 'semantic decomposition', the second the idea of 'semantic integration'.

Semantic decomposition

The relationship between words and meaning has long been a major concern of linguists and psychologists (see Miller, 1972 and Miller and Johnson-Laird, 1976, for theoretical accounts). At least two methods have been proposed by which words with similar meanings are related in memory (Kintsch, 1974): the 'transformation' or 'decomposition' hypothesis where the lexical memory representations of certain words are transformations of the representations of 'source' words; and the 'lexicalist' hypothesis which states that words with similar meanings are stored separately in memory, but share features. Properly speaking, the components assumed by the decomposition hypothesis are not fixed in number and may be gained or lost; features, however, are fixed in number and may only change value. Kintsch summarises the debate among supporters of the two theories, and concludes that "what is required are studies involving lexically complex words in which the task requirements do not force the comprehender to analyze these expressions into their components" (1974: 223).

In a series of experiments using sentence generation, sentence completion and phoneme monitoring, Kintsch (1974) failed to demonstrate that lexically (ie semantically) complex words (those with a greater number of semantic components), eg 'sell' or 'approach', were more difficult to process than lexically simple ones such as 'give' or 'go'. Two cued recall experiments also failed to demonstrate spontaneous semantic (or lexical) decomposition, but subjects apparently could decompose when required to do so, suggesting that decomposition was not necessarily a feature of episodic memory, though it might be of lexical or semantic memory.

Gentner (1975) and Abrahamson (1975), working within the LNR framework, both present evidence for semantic decomposition. Gentner studied the order of acquisition of verbs of possession by children, and found that semantically complex words were acquired after simpler ones. Abrahamson investigated the free recall of text containing verbs of motion and showed how the pattern of substitutions could be understood in terms of the substitution, omission and intrusion of semantic elements. Interestingly, Abrahamson comments that "the number of semantic elements is a measure of the perceived complexity of the situation referred to, but not of the processing complexity" (1975: 273), which directly contradicts an assumption underlying Kintsch's experiments.

A later study by Gentner (1981) makes a distinction between two versions of the decomposition hypothesis: the 'complexity' hypothesis, the traditional view adopted by Kintsch and Thorndyke (1975a, 1975c) amongst others, and a 'connectivity' hypothesis, which makes assertions about the *structure* of the relations formed among the semantic components. In three sentence recall experiments only the connectivity hypothesis successfully predicted the relative difficulty of remembering nouns having differing associations with the verb.

Verbs have usually been the object of enquiry in semantic decomposition research, probably because they offer greater complexity for study than nouns. In the data analysed in Chapter 7, it was verbs which underwent the highest incidence of substitution, the shift toward simple high frequency words being easily interpreted by the loss of attributes. Nouns underwent substitution less frequently, and showed little evidence of the loss of feature information: substitutes were dominated by what in the passage were equivalent referents, which probably masked all other effects. It ought to be possible to demonstrate decomposition for nouns too; this may involve features and attributes after the manner of concept formation research (eg Mervis and Rosch, 1981; McNamara and Sternberg, 1983) rather than the case relations and various qualifications which enter the representation of verbs.

The concept of semantic decomposition naturally extends to include the instruments of actions, which are often inferred by subjects if not initially present (Garrod and Sanford, 1981; Dosher and Corbett, 1982; Boscolo and Capozza, 1983). The present analyses did not specifically address themselves to this issue, and the intrusions found in Experiments I-III, though inferential, mostly involved inferences from elsewhere in the passages.

Semantic integration

'Semantic integration' (or 'linguistic abstraction') is the phenomenon first described by Bransford and Franks (1971) whereby information originally contained in several different sentences in a list or a text is combined in memory to form a semantic whole, which they termed a 'schema'. Subjects were able to recognise original information with high accuracy, but not the particular combinations of information present in individual sentences, which were apparently forgotten. A great deal of research immediately after this paper extended the original findings to cover abstract sentences (Franks and Bransford, 1972), text (Bransford and Franks, 1972; Bransford and Johnson, 1973), pictures (Franks and Bransford, 1971) and films (Cofer, 1973). Inferences were also incorporated into the 'schema' and became indistinguishable from original information: these involved implied relations (Bransford, Barclay and Franks, 1972) or real-world knowledge (Johnson, Bransford and Solomon, 1973; Fillenbaum, 1974).

Bransford and Franks (1971) had claimed that their technique "would lend some precision to Bartlett's (1932) notion of abstract schemas", but despite their considerable successes, the research they inspired has sought more to describe the *extent* of the phenomena, than to develop a structural (perhaps network) model of memory. An exception to this is the development of a 'schematic illustration' of the relationships among the information within a paragraph given by Bransford and Franks (1972: 239), which is definitely 'thematic' in the sense used here, being organised around various objects and activities. But Bransford (1979) was still speaking of this semantic integration in terms of its necessary conditions and limits in a totally non-structural way.

The experiments reported here support the idea of semantic integration in several, albeit tentative, ways:

1. Intrusions (Section 7.6) were inferential in nature, or at the worst consistent with the passage as recalled, and more like an extreme form of nonverbatim recall than genuinely imported new information. If they derive from exactly the same memory structures as more accurate information, those structures must contain passage material integrated with information from elsewhere within the passage, as well as from outside knowledge: this would be expected to give recall resembling the intrusions that were found. Further investigation of the nature of the memory representation might profitably begin with a more detailed analysis of intrusions.

2. One feature of subjects' scripts noted in the qualitative clause analyses (Section 7.2) was confusion among similar objects, activities, descriptions etc occurring in different places in the passage. While a variety of explanations may be proposed for this, it is consistent with the similar items being semantically integrated together. The apparent loss of some readily inferable material, may result from its not being distinctively encoded, again consistent with integration.

The clustering results for Experiment V might have been expected to show clear evidence of semantic integration, which would have generated the same predictions, of noncausal thematic clustering, as the generalised knowledge-based position, but the results of that experiment failed to support any position. On the other hand, the clustering that was found for Passage 3B, being primarily topic-based, does support semantic integration.

Bransford and Franks (1972) began to demonstrate how semantic integration leads logically to a thematic, topic-based, knowledge-led theory of discourse processing, but did not carry out the original promise. The semantic integration literature can nevertheless contribute to understanding and developing a knowledge-led theory.

Recall editing

The effect of most of the manipulations of Experiments I-III has been to alter the verbatim recall component considerably, but the nonverbatim and intrusive components little or not at all. Two particular circumstances gave the opposite pattern of results: delaying recall, especially the first recall attempt of a passage, and giving instructions to subjects which varied the importance they had to attach to unreliable information. A simpe interpretation could be placed on these findings: that subjects used a recall criterion to 'edit' what they actually recalled for overt reproduction. It must be assumed that subjects make a reliability estimate, which is objectively quite accurate, of what they can recall, and compare this with their current criterion level.

The evidence from intrusions, as the least accurate recalled material, supports this explanation. Intrusions increased under the 'liberal' instructions of Experiment II, and in the delayed first recall condition of Experiment III where there was also an increased proportion of longer and more 'extreme' intrusions. It is easy to suppose that subjects' recall criteria changed in response to the instructions of Experiment II. The delayed first recall condition of Experiment III was the most difficult situation subjects were placed in and this might have forced their recall criterion down (to avoid recalling virtually nothing); alternatively, the instructions for the delayed condition, by providing recall cues, may have given the impression that less accurate information was acceptable. Though not conclusive, the evidence does fit a consistent picture.

Summary

Consistency rather than conclusiveness is the hallmark of the results discussed above. Within this overriding qualification, a picture of the memory representation of discourse has begun to take shape. Firstly, the discreteness of the proposition was not upheld, and a more general conception of that level of encoding had to be introduced. The nature of verbatim recall was resolved in favour of a single unified memory representation, albeit one containing information of widely varying accuracy and detail. The accuracy differences are recognised by subjects and are used to determine the content of recall.

Memory contains information at a number of levels of detail, and the way this detail is apparently lost argues for a componential representation as described in the semantic decomposition literature. This implies that the verb has a special role to play in the organisation of memory for discourse, and that the clause may be a natural processing unit. Tentative support was also provided for a 'semantic integration' description of the formation of the memory representation. Both semantic decomposition and semantic integration consider memory and comprehension to be thematically based, the former explicitly claiming that the episodic representation of an item derives from the corresponding entry in semantic (or lexical) memory. They are therefore in good agreement with the knowledge-led processing approach.

8.3 MEMORY ORGANISATION

Structural relations

Information derived from text must be organised in some way for any further use to be made of it, and the responsibility for identifying structural relations in text and organising information taken from it rests with the learner. Understanding this organisation is therefore crucial to understanding how discourse is represented in memory.

It was seen in Chapter 2 that two types of relation seemed particularly important in memory for discourse: thematic and causal. This observation was reinforced by a review of some theories of text comprehension (Chapters 3 and 4), from which two classes of theory emerged: those stressing abstract structures for text organisation, and those which emphasise the role of prior knowledge. Most of the models in the literature are either empirically unsupported or theoretically premature, so it was decided to investigate the fundamental issues underlying memory organisation first, and work out the implications for developing a more cmplex model later.

Knowledge-led versus text-led processing

The two generic approaches to discourse structure found in the literature were described thus in Section 4.1:

1. 'Text-led' theories in which organisation is mainly causal, peculiar to text, and relatively independent of text content; the dominant example is the variety of story grammar approaches, but some research with scripts and macrostructures are also text-led.

2. 'Knowledge-led' theories where organisation is based on prior knowledge, is primarily thematic, and is closely dependent on content; the best examples are the recent mental model and story point approaches, though some script-based research falls into this category.

At the level of interitem relations, the two types of theory are most easily distinguished by the importance they assign to noncausal thematic associations in comparison with causal ones (Section 6.1).

Structural relations were studied directly in two ways: by the recall contingencies among pairs of clauses, and by the manner in which clauses clustered at recall (an extension of the contingency analyses). As demonstrated in Chapter 6, both techniques showed that noncausal thematic relations were just as important as causal ones in determining the recall associations among clauses, and the knowledge-led position was considered to have been confirmed.

Experiment V was performed specially to clarify this distinction in a single passage, but was unable to do so, mainly because of a failure of the passage used to show any serious degree of clustering. The low level of clause clustering in three of the four passages investigated, all basically narratives, was taken to indicate that narrative material does not lend itself easily to clustering. This is particularly puzzling since both text-led and knowledge-led theorising would predict strong recall associations among the clauses of narratives. The cluster analyses were not uniformly unsuccessful: most of the a *priori* groupings of clauses in Passage 3B, which was not primarily narrative, were retrieved. An explanation for this unexpected behaviour of narrative stories will be sought below.

Serial position

The influence of serial position on clause recall was investigated because of its links with overall structure. Recall undoubtedly favoured the beginnings of passages, though it was difficult to demonstrate the expected inprovement in recall for final clauses. The preferential recall of early clauses seemed to occur almost regardless of their structural function or content. Several times in the cluster analyses of Passage 3B, which showed most clustering, an isolated early clause was found inexplicably grouped with an otherwise logical set of later clauses. It looked as if subjects were desperately trying to cluster the early clause, however peculiar its associates might be. Thus not only are early clauses well recalled, but subjects appear to deliberately combine them with later information.

In following the normal conventions of story construction, it is inevitable that early clauses should contain information to orient the reader and facilitate subsequent comprehension. Studies of the structural disruption of prose material probably owe much of their finding of severely impaired memory and comprehension to the inappropriateness of early information (eg Wees and Line, 1937; Kintsch, 1977; Bailyn and Krulee, 1983). Analysis of the present data showed, not unexpectedly, a preferential recall for 'scene setting' information, ie items introducing actors, topics or events, or which 'mapped out' the main plot. This could explain some of the preferential recall of early clauses, but it is not enough: unimportant early items are well recalled too. If subjects, as is likely, do not know when beginning to read a passage what is scene-setting (and important) and what is not, they may pay special attention to *all* early information, and work its value out later. This might have produced the odd clustering effect with Passage 3B: the associations with later clauses may have been formed while subjects were still trying to work out the utility of early items.

Clause level

Two other approaches to passage structure were discussed in the course of the analyses. Firstly, 'levels' within the overall structure of passages had been assigned to individual clauses (Sections 4.2 and 4.6). These were loosely defined by the 'dependencies' formed with other clauses. Levels have been defined before from various theoretical positions and found to predict the recall of propositions (eg Meyer, 1975; Thorndyke, 1975a; Kintsch and van Dijk, 1978; Yekovich and Thorndyke, 1981; Wilensky, 1983). This was further confirmed for clauses by Experiment I, lending limited validity to the present description of clause level, and suggesting that the structural descriptions of Chapter 4 have as much validity as earlier attempts, though other structural evidence indicates that clause level is just one of a number of factors affecting recall.

The relations involved in the present definition of levels included a variety of causal and other thematic connections, as well as temporal sequencing. For each clause it was judged which other clause was best considered its *logical prerequisite*. Whatever their ostensible basis, other definitions of levels probably contain logical prerequisites in their relations, and this could provide the most general explanation of the 'levels effect'.

Higher order structures

Higher order structure, ie above the level of immediate interrelations among propositions or clauses, was not investigated directly here, but large scale structures were implied by some of the findings. An attempt was made in Chapter 4 to describe the differences among clauses of higher and lower recall frequencies, and this was repeated in greater detail in Section 7.2. The first analyses distinguished the two sets of clauses by differences in the 'redundancy' (repetitiveness or predictability) of their content, or their 'peripheralness' to the main story-line. Peripheralness was especially interesting because it appeared to relate individual clauses to overall passage structure in thematic terms.

Unfortunately, neither of these factors were confirmed when original clauses were presented to independent judges (the 'rating study'). Experiment IV attempted to manipulate the relationship between a group of clauses in the middle of a passage and the passage as a whole (ie the peripheralness of the clauses), but again failed to confirm the reality of peripheralness. More extensive qualitative analysis appeared to confirm that clauses containing information that could easily be inferred from elsewhere in a passage were less well recalled, but added no more to the idea of peripheralness.

The cluster analyses failed to identify any high-level units of organisation among the clauses recalled, except for the reconstructed groupings of Passage 3B, but given the nature of the data, this is perhaps not surprising.

Passage structure

The nine passages for Experiment I comprised three stories of each of three structural 'types': linear and branching narratives, and nodal passages. As explained above, these types were described in terms of a *priori* dependencies or logical prerequisites among their constituent clauses. Although there were significant differences in word- and clause-scores among the passages in Experiment I, none seemed related to the three structural types.

In the contingency and cluster analyses, Passage 3B showed many more associations among its component clauses, and consequently more clustering, than the others. It was suggested that where a passage had a strong narrative line, that this somehow prevented associations among clauses becoming apparent at recall, contrary to the expectations of either text-led or knowledge-led theories. The pronounced 'levels' effect found with 'branching' narrative passages (Section 4.6) shows that there *are* structural differences of psychological significance among their clauses, but Passage 2C, branching in structure, showed very little recall clustering. Even more perplexing were the negative contingency and clustering results for Passage F in Experiment V, which had been modelled on a narrative of very clear plot structure from the story grammar literature.

More detailed analysis of clause recall (Section 7.2) using all nine passages from Experiment I suggested that there were effectively only two types of passage structure: 'narratives' with a dominant linear sequence, and 'nodal' passages consisting of a series of relatively independent segments; branching passages were perceived by subjects as either narrative or nodal. The qualitative analysis of word recall (Section 7.3) indicated that verbs might be particularly well recalled in narrative passages and nouns in nodal ones, which makes sense if narratives are organised around actions, and nodal passages around objects or actors.

The failure of narrative passages to demonstrate recall clustering is problematic: if the frequency distribution of recall contingencies was inadequate for clustering, though the circumstances seemed to show otherwise, then only an increased quantity of data can resolve the issue. Assuming that the data is adequate, however, gives rise to three explanations worth entertaining:

1. Clustering in memory does *not* occur because the dominant pattern of associations among items is *sequential*, albeit with numerous exceptions. No unique clusters are formed because each clause is associated with both earlier and later clauses in memory.

2. Clustering does occur, but the 'redundancy' built in to the components of the narrative sequence is sufficient to allow subjects to select different clauses for clustering; averaging over all subjects then masks the clustering pattern of any one of them.

3. Clustering does occur, but it takes place on a level above or below the clause, which is not then the appropriate unit of analysis.

4. Clustering does occur in recall proper, but the effects are masked by narrative constraints on overt reproduction.

If the level of clustering is above the clause, then clause associations would still reflect it; clustering *only* at a level below the clause is unlikely in a narrative where the unit of action must be the verb or clause. This argues against option (3). If option (2) were true, one would still expect to find associations among *pairs* of clauses, but these were as weak as clustering; option (1) seems eliminated by this point too, despite its consistency with the tentative distinction made between narrative and nodal passages. The final possibility is not unlikely, given the recall editing that has been demonstrated, but without an alternative method of assessing memory, such as recognition with which to compare free recall, it remains a just a suggestion.

Semantic structures

Knowledge-led comprehension depends on the structures formed by prior knowledge of the items in a passage. The evidence presented so far favours knowledge-led over text-led processing, but has focused on the nature of the episodic representation (in Tulving's, 1972, sense): the influence of semantic memory has not yet been considered. As mentioned above, the notion of semantic decomposition asserts that episodic representations may be based on corresponding structures in semantic memory. It is therefore timely to consider what these semantic memory structures might be and what role they are likely to play in discourse comprehension. In Section 7.3 it was suggested that narrative and nodal passages were dominated by nouns and verbs respectively, which might correspond to organisation centred on persons or objects, and activities.

At least two types of semantic memory structure may be suggested for activities: those centred on individual verb meanings (better called 'actions'), and more complex organisations incorporating several actions and other information ('activities'). For actions, case grammars (eg Fillmore, 1968) or the verb structures analysed in studies of semantic decomposition (eg Abrahamson, 1975; Gentner, 1975, 1981; Garrod and Sanford, 1981) provide models. For activities, the script (Section 3.5) gives a well-researched lead: Bower, Black and Turner's (1979) 'partial copy' explanation of how scripts might be used to structure memory for stories has episodic memory following the organisation of semantic memory exactly as a knowledge-led theory seems to require.

Semantic memory for objects, actors and other, more abstract entities is usually considered to consist of 'concepts'. Conceptual knowledge is organised around categories which relate to each other in a strongly hierarchical fashion (eg Collins and Quillian, 1969) and categories have their own internal structure (Anderson, 1980; Mervis and Rosch, 1981). The 'prototype', which has similarities with 'stereotypes', is probably the nearest equivalent of the script in conceptual knowledge.

A distinction similar to the present one has been made by Mandler (1979). She discussed two kinds of knowledge: 'categorical' and 'schematic'. Categorical knowledge is strongly hierarchical and is based on class relationships among relatively simple items, whereas schematic knowledge is built from frames which have considerable internal structure, but only loosely specified interrelationships. Although no work has yet attempted to apply such distinctions to discourse comprehension, a suggestive study by Lompert and Kinsbourne (1981) has found at least developmental differences between sentences containing action and stative verbs in recall. Clearly, understanding the kind of structures that semantic memory consists of should enable us to understand better the episodic structures formed from discourse.

Summary

Knowledge-led processing of discourse has been supported by the clear role of noncausal thematic relations in memory structure, though no higher order structures were found. There was tentative evidence for the prior distinction between 'nodal' passages in which organisation apparently centres on objects or actors, and 'narratives' where organisation is based on activities, though the intermediate category of 'branching' passages may not have been distinguished by subjects. A 'levels' effect, based on a *priori* clause relations was observed, but could not explain many of the differences in recall among clauses or passages. Knowledge-led processing implies that semantic memory plays a part in structuring the episodic representation, and two kinds of knowledge can be identified in the semantic memory literature which might mediate this structuring.

Early clauses and the sort of information that they typically contain were both particularly well retained. The importance of early clauses in the processing of the stories was emphasised by the preferential recall of unimportant early items and the way subjects associated early clauses with later ones in remembering one of the passages. Though weak evidence, such observations can help us to put together a processing model of how knowledge-led comprehension takes place, explored further in the next section.

8.4 TEXT COMPREHENSION

Introduction

Comprehending discourse is a complex interaction among a number of processing 'stages' (La Berge and Samuels, 1974; Just and Carpenter, 1980; Marslen-Wilson and Tyler, 1980). We make sense of text *as we encounter it*, not after we have committed a complete passage to memory, and the memory representation we derive from text is the product of these processing stages. General support has so far been given to knowledge-led theories of discourse comprehension, largely on a basis of evidence about the memory representation. This section will now examine what these theories have to say about the processes of comprehension.

Attention and selection

Comprehension and memory are selective: all components of a text are not of equal interest to the reader or of equal value in interpreting other text information. This not a new idea: for example, Gomulicki (1956a) used the term 'abstraction' to denote the attention paid to 'important' items in a text, but was unable to define it precisely. Any theory of discourse comprehension must explain selective processing, even the possibility that different subjects might attend to different topics in the same passage (cf Flammer and Tauber, 1982), which is not easily accounted for by text-led theories.

In the mental models approach to discourse comprehension (eg Garnham, 1981, 1983; Johnson-Laird, 1981c, 1983), a 'proper' text has a unity not wholly explicable by the interrelations of its propositions, which only lend 'coherence'. The additional factor is 'plausibility', the likelihood or intelligibility of its contents to the subject. Plausibility is dependent on subjects' being able to construct a 'mental model', ie an integrated mental representation above the 'propositional' level, which is consistent with his expectations and past experience (see also Mani and Johnson-Laird, 1982). It is logical to suppose that while reading or listening to a text, a subject is trying firstly to work out *in general terms* what the model is going to be about, and secondly to look especially for those items that will aid the construction of the model.

Other knowledge-led theories make similar proposals. For example, Wilensky's theory of 'story points' claims that "the main goal of a story reader is to determine the points of a story and to structure what is remembered in terms of its points" (1983: 153). Script theory research, when knowledge-led, is not always so clear. Bower, Black and Turner (1979) investigated the effect of 'interruptions' to a script (see Section 3.5) on memory for text based on that script. Interruptions may be the reason for telling or reading a particular story, and were particularly well remembered. It is reasonable to suppose that subjects select them out for special processing, like Wilensky's story points.

The idea that in comprehension we selectively attend to information under guidance from both past experience and what has already been understood is not unique to knowledge-led theories. However, such theories give their own descriptions of the nature of this guidance, which seems to operate on two distinct levels: the individual items (propositions) within a passage, and the the main points of interest, which need not be expressed at the propositional level. Inevitably, processing at the propositional level must precede any subsequent stage in comprehension (cf Mani and Johnson-Laird, 1982), but is still likely to be guided by the theme or topics of interest. Among knowledge-led theories, the mental models approach seems weakest in describing how comprehension takes place (Garnham, 1983, is probably clearest).

For any information to guide processing, it must be employed very early in comprehension or the interim memory load imposed will become insuperable. Rather than build up progressively from the propositional level, comprehension may identify the general nature of the top levels as soon as possible. The better recall of early items in a passage (whether important or not) can be explained by this need to establish point or purpose early, as is the odd clustering behaviour noted for one of the passages (previous section). To retain old information ready for associating with new information, and to continue to bear in mind the points that the comprehender is looking for in a passage, logically requires some sort of working memory.

The role of working memory

Many authors have considered the possible functions of a short-term or working memory in text comprehension (see also Section 1.2). The model of working memory proposed by Baddeley and Hitch (1974), and restated by Hitch (1980) and Baddeley (1981), describes working memory as a collection of temporary stores in which information may be held and manipulated. For verbal information, these number an output buffer, which doubles as an 'articulatory loop' for rehearsal; a 'central executive' which governs information encoding and transfer; and an input buffer where information cannot be manipulated (and which is not therefore part of working memory proper).

In normal speech comprehension and reading, the articulatory loop may not be used (Baddeley, 1979; Hitch, 1980), but the central executive (Martin, 1982) and the input buffer (Hitch, 1980) are. An input buffer of some kind seems a necessity given the complex sequence of decoding that language must undergo, and the need to hold strings of words or propositions between processing stages (eg Clark and Clark, 1977; Marslen-Wilson and Tyler, 1980). In text processing, the clause is probably the unit of processing, and subjects can normally hold only one or two clauses or sentences in working memory at once (Jarvella, 1979; Glanzer, Dorfman and Kaplan, 1981). Normally, only the most recent clause or sentence is accurately retained in memory, but coreference and subordination between clauses greatly enhances memory for a preceding clause, suggesting they are associated or processed together (Jarvella, 1979).

In addition to functioning as a temporary store in language comprehension, it has often been suggested that working memory holds recent but *selected* propositions to aid the comprehension of new material (eg Kintsch and van Dijk, 1978). Predictions from the Kintsch and van Dijk model have been confirmed by Fletcher (1981). Hirst (1981) and Sanford and Garrod (1981) discuss the role of 'foregrounding' or 'focus', ie recent topics that are still at the 'front of consciousness', in anaphor resolution and similar activities. Sanford and Garrod extend 'focus' to include the currently active 'scenario' (an interpretive frame-like memory structure).

Thus far, working memory functions in discourse comprehension have been proposed at two levels, but Sanford and Garrod's application of 'focus' to scenarios brings in a third level which cannot obviously be subsumed under the Baddeley and Hitch model, yet which is necessary for a knowledge-led theory of comprehension. If 'story points' are used to guide processing, they must be retained somewhere that is continuously accessible, and be capable of rapid modification as comprehension progresses. This raises the question of whether what is extracted or constructed to aid comprehension is functionally distinct from the use of prior knowledge.

Of the three working memory components proposed above, only the first has firm empirical support. Kieras (1981a) has put forward evidence for what are probably the first two: a 'working memory' in which links between propositions are constructed prior to incorporation into long-term memory, and a 'short-term memory' where a list of recent or current topics is maintained by rehearsal. Knowledge-led theories have been traditionally weak in considering the need for working stores, but discourse comprehension appears to require three distinct levels of storage under any model.

Scenarios

Sanford and Garrod (1981) contrast two approaches to text comprehension :

1. A 'propositional' approach where the representation extracted from sentences is integrated by argument repetition or bridging inferences.

2. A 'scenario' account, in which an appropriate 'domain of reference' in memory is identified and used to interpret subsequent information.

Their distinction resembles that drawn here between knowledge-led and text-led processing (they even exemplify scenarios by verb decomposition and scripts), but there are fundamental differences:

1. Knowledge- and text-led refer to the *organising principles* applied discourse during comprehension which help structure the memory representation: Sanford and Garrod use theirs primarily to explain anaphor resolution and inference making.

2. Knowledge-led processing employs various constituents of semantic memory, some of which may be frame- or script-like, but none of which are assumed to be: Sanford and Garrod consider only scenarios which are explicitly frame-like (verb decompositions are described as 'mini-scenarios').

Thus, the two accounts differ in the nature of the distinctions which they draw and in the phenomena to which they are applied.

This comparison highlights the limitations of the two approaches, however: Sanford and Garrod discuss comprehension and organisation on a propositional level, concentrating on the details of representation and 'on-line processing'; this Thesis focuses on more general issues of the memory representation, and the types of information used in comprehension. Clearly, either could be extended to include the central concerns of the other.

Summary

Knowledge-led theories of discourse comprehension are relatively new and in need of development. They have not yet advanced detailed processing models (except possibly for script theory which is not always knowledge-led). By discarding abstract notions of story structure, they pay more attention to passage content; this is reflected in the local and global organising principles they employ, their use of structures from semantic memory, and their implied utilization of working memory.

Knowledge-led processing probably begins by identifying, from external information or from very early in the passage, the main points. These determine two things: the components of semantic memory that must be brought into play, and the topics or themes that it is most important to search out from the passage. In addition to its usual function in language comprehension, working memory must hold both the global points for comprehension and the current local topics, and update them appropriately. An episodic memory representation is built up, organised by the semantic memory structures as well as by the content of the passage. This representation is encoded on a series of 'levels', of which the most detailed are the most easily lost.

The present conception of knowledge-led processing goes further than any of the three knowledge-led theories it derives from, and it would be wrong to suggest that it does no more than average a few pre-existing models together. It describes the principles behind the organisation of episodic memory in greater detail than the mental models theory; it describes the function of semantic memory better than Wilensky's story points; it discusses processing during comprehension more precisely than many applications of scripts without being trapped into assuming that all structure is script-like. Finally, the knowledge-led model proposed here demonstrates consistencies among earlier theories.

8.5 CONCLUSIONS

Problems

Among the problems already mentioned in the study of memory and comprehension for discourse may be mentioned the following :

1. The semantic memory structures claimed to organise and interpret the episodic representation of text need to be clarified and their influence better demonstrated.

2. The way in which text content and the semantic structures must interact in forming the episodic memory has not been discussed yet. Perhaps a generation-search-match cycle is involved, where a proposed structure is looked for in the input data, tested against it, and the episodic structure
modified or passed and extended as a consequence.

3. Improved understanding of semantic structures and their use in comprehension should enable us to predict more precisely the interrelationships among passage elements for empirical testing.

4. Knowledge-led theories provide little detail about the nature and function of higher order structures derived from discourse. Do 'mental models' guide comprehension in the way that 'story points' are supposed to, and how is either structured?

5. None of the knowledge-led theories except the script-based approaches have attempted to describe the memory representation directly. The problems of the network models discussed in Chapter 1caution against premature theorising, but a start should be made because knowledge-led processing would give its own characteristic structures.

6. The uncertainties surrounding the possible roles and components of the working memory system have already been discussed; this system must be central to future processing models.

7. The loss of information during retention was held to support semantic decomposition, but needs to be developed much further in the context of a multi-level memory representation.

8. The mechanisms underlying recall have not been considered so far, and depend very much on the sort of memory structures that are proposed. The

extent and motivation of recall editing may make free recall protocols a more difficult source of data than has been assumed.

There is a natural temptation to begin describing a detailed model on existing data, but the reviews of Chapters 1-3 contain too many cautionary examples of premature and over-formalised theory building to justify so rash a step.

Methods

Finally, it is left to draw a few conclusions about the methods adopted here which have often not been widely used before:

1. Free recall was adopted here because of the large amount of data it generates, which was necessary for some of the analyses. The potential extent of subjects' editing of what they recall before committing it to overt reproduction is worrying, and might upset structural analyses in particular if the conditions of the experiments demand that material be presented to the Experimenter in an organisation different from that in which it is found in memory. Many of the present findings therefore require confirmation from studies using techniques such as recognition or question answering.

2. Despite the special attention devoted to passage construction in the present study, there were difficulties in obtaining clear results in three of the five experiments performed, apparently traceable to passage construction. On the other hand, the set of passages written for Experiment I did prove useful, and merit more extensive study, by extension of the structural analyses for example.

3. The structural analyses of Chapter 6 hold great promise and several lines of development suggest themselves. The cluster analyses contain two assumptions which might be changed: each clause is only allocated to one cluster, and no consideration is given to sequentiality or adjacency among the clauses recalled. These last two factors might form the basis of new analyses or be incorporated into the clustering algorithm.

4. Chapter 7 introduced a series of *ad hoc* qualitative analyses supported by with quantification wher possible. Some of these, particularly the descriptions of nonverbatim and intrusive recall, deserve further investigation.

Summary

The experiments reported here suggest that the mental representation of text consists of information on a variety of levels of detail and accuracy; the accuracy of encoded information is recognised by subjects, and the finer detail tends to be lost first. Significant verbatim encoding is probably absent, and the status of the proposition as a discrete unit in memory has been called seriously into question. The structural relations by which information from text is integrated into this representation are probably thematically based, reflecting initial processing by key topics selected from within the text, and the way information corresponding to these topics is organised in semantic memory. The relations described by text or story grammars seem to play no part in either comprehension or the memory representation. Though the memory representation has been the focus of attention here, a knowledge-led theory has implications for the 'on-line' processing of information in terms of both the principles governing information selection and the role of working memory, some of which have been discussed above.

Overall, this picture is consistent with several of the more recent approaches to discourse comprehension in the literature. Uncertainty surrounds most of the findings reported here, however, and some of the major theoretical problems concerning text comprehension have just been out. But it cannot be stressed too highly how dependent are the results of research in this area upon the materials, methods and analyses employed.

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APPENDICES

APPENDIX 1.1: EXPERIMENTS I AND II: PASSAGES

Passage 1A

NO.	LVL	WDS	CLAUSES
1	0	9	One day Ernu decided to hunt the giant armadillo.
2	0	6	He went to his grandfather first
3	0	7	and borrowed some of his poison arrows,
4	0	5	then visited the village shrine
5	0	7	and prayed to his tribe's ancestral spirits.
6	0	8	After this he walked deep into the forest,
7	0	12	where he slept the night on some dry leaves in a cave.
8	0	10	Early in the morning he was wakened by a noise
9	0	9	and crept out of the cave into the moonlight.
10	0	11	At first he could see nothing except the misty river banks,
11	0	9	but eventually noticed a humped shape some way off.
12	0	7	Suddenly the shape vanished into the forest.
13	0	4	Ernu ran after it.
14	0	10	He plunged into the undergrowth, bow and arrows in hand.
15	0	10	He followed the animal's tracks for over half an hour,
16	0	8	until he came out into a swampy clearing.
17	0	6	He looked around for a while
18	0	8	before espying a shadowy depression in the undergrowth:
19	0	7	quickly he fired several arrows into it.
20	0	5	There was a loud roar.
21	0	3	He ran over
22	0	6	and found the fabulous giant armadillo,
23	0	6	but it was already quite dead.
24	0	5	Ernu jumped among the bushes
25	0	9	to skin the monster of its tough, legendary hide.
26	0	11	Then he had to drag the bulk back through the forest,
27	0	8	and after many hours reached his tribe's village.
28	0	7	He showed the hide to his grandfather,
29	0	4	who was so proud
30	0	8	that he gave Ernu a fine timber hut.

Passage 1B

NO.	LVL	WDS	CLAUSES
1	0	4	When Trevor's grandmother died,
2	0	7	she left a long and complicated will.
3	0	9	Three lawyers had to decipher it for a month
4	0	6	before concluding that, amongst other things,
5	0	8	Trevor had been left his grandmother's favourite cockatoo.
6	0	8	He took it back to his bed-sit
7	0	7	and placed its cage in the window,
8	0	10	where it sang all day and most of the night.
9	0	11	After a week, this began to strain Trevor's nerves rather badly;
10	0	10	but after a fortnight he could stand it no longer.
11	0	11	At tea one evening he suddenly jumped out of his chair
12	0	3	and dashed upstairs.
13	0	7	He returned with an old, voluminous suitcase,
14	0	12	into which he stuffed the cage with the poor cockatoo in it.
15	0	8	That night, he put on an old raincoat,

NO.	LVL	WDS	CLAUSES
16	0	8	stole quietly out of the dark boarding-house,
17	0	6	and made for the nearby cemetary.
18	0	9	He quickly found the recently dug grave by torchlight,
19	0	6	and dropped the suitcase by it.
20	0	9	From under his coat he brought out a spade,
21	0	8	and frantically began shovelling earth from the grave
22	0	9	until the spade struck the wood of a coffin.
23	0	10	Then he threw the spade down on to the ground,
24	0	5	climbed out of the hole,
25	0	7	and tossed the suitcase to the bottom.
26	0	5	After hastily filling it in,
27	0	6	he heaved a sigh of relief
28	0	4	and walked thankfully home.
29	0	5	Immediately he went to bed
30	0	7	and that night slept like a log.

Passage 1C

NO.	LVL	WDS	CLAUSES
1	0	8	One evening I went to a dull party
2	0	10	and I met Mr Angschmidt, manager of Mechanical Contraptions Ltd.
3	0	9	The following week he invited me to his factory
4	0	7	and showed me his latest production line.
5	0	6	It began in a dim workshop
6	0	10	where a steel plate was pressed into several curved pieces.
7	0	6	Workmen smoothed off the rough edges
8	0	7	before sending them to a second workshop.
9	0	9	There, a man in white in white overalls polished the pieces
10	0	7	and washed them with a special solution.
11	0	4	When they had dried,
12	0	7	he painted them with a tough enamel
13	0	11	and passed them carefully to his friend on the next bench.
14	0	8	This man took a frame of copper struts
15	0	6	and carefully attached the steel plates.
16	0	5	This produced a shiny cylinder,
17	0	9	and a boy took it into the electrical laboratory.
18	0	8	One technician fitted it with an electric motor
19	0	11	and then clipped a fan to the end of the motor.
20	0	5	Somebody else soldered wires on,
21	0	5	drew them through a hole,
22	0	6	and plugged them into a socket.
23	0	4	The machine was tested
24	0	8	before being carried to a large assembly room.
25	0	8	A woman bolted a cover over the base,
26	0	3	attached rubber wheels,
27	0	7	and clipped a bag over the back
28	0	9	and put the completed product in a cardboard box.
29	0	12	A machine stamped "handle with care" and a picture on the box:
30	0	10	only then did I recognise it as a vacuum cleaner.

Passage 2A

NO.	LVL	WDS	CLAUSES
1	0	11	Many years ago, the Parali people stopped wandering over the hills,
2	0	5	and settled in grass huts
3	1	8	that lay by the loop of a river,
4	1	7	and which had been built on stilts

NO.	LVL	WDS	CLAUSES
5	2	6	to protect them from periodic flooding.
6	0	8	They had lived here happily for many years,
7	1	6	fishing in the placid waters nearby.
8	0	7	But their contentment was disturbed one day
9	1	4	when someone pointed out
10	2	6	that every time the river overflowed
11	3	9	it weakened the precarious bamboo stilts under the huts
12	3	7	and washed away some of the soil.
13	0	9	The chief of the tribe too began to worry -
14	1	5	he was very happy there
15	1	6	and didn't want to move.
16	0	8	He called a gathering of all the men
17	1	3	to discover urgently
18	2	5	how many of them thought
19	3	11	that the erosion of the soil had become such a danger
20	4	10	that their huts might any day tumble into the river.
21	0	9	The men decided to evacuate the village at once.
22	0	9	They gathered families and goods from their dwellings
23	1	7	to be loaded on to wooden carts
24	2	10	which had been idle since the nomadic days long ago.
25	0	10	Finally, when the village was empty of people and possessions,
26	1	8	the medicine man chanted a long, sad song,
27	2	8	and set fire to the dry grass roofs
28	2	7	while his son beat furiously on drums.
29	0	12	Then the Parali and their belongings moved slowly off into the forest,
30	1	4	to become nomads again.

<u>Passage 2B</u>

NO.	LVL	WDS	CLAUSES
1	0	10	Mrs Taylor had taken her two children to a toyshop
2	1	5	so she could find out
3	2	6	what they wanted for Christmas presents.
4	0	7	They entered the shop through glass doors
5	0	12	and soon stood in front of a large display of toy soldiers.
6	1	9	Some of them had been stood alone on shelves,
7	1	5	others engaged in mortal combat
8	2	7	raising bayoneted rifles high above their heads
9	3	9	as if to pierce each other through the heart.
10	0	4	Mrs Taylor moved on,
11	1	7	though her children didn't want to.
12	0	6	Then they found the electric trains -
13	1	8	a huge table was given over to them
14	2	8	where they purred round and round all day,
15	3	7	some pulling passenger carriages between miniature stations,
16	3	6	others shunting wagons between various sidings.
17	0	9	But the children had no wish to watch trains
18	0	8	and pulled their mother over to another stand
19	1	8	where a toy spaceship emitted lights and noises
20	1	11	and some other small machines ground over an imitation lunar landscape.
21	0	4	Mrs Taylor waited patiently
22	1	10	while son and daughter ran from one display to another
23	2	3	just to see
24	3	11	how the marvels of the second exceeded those of the first.
25	0	5	Sadly she realised that thing
26	1	9	which they in their delight had forgotten all about.
27	0	10	They would have to without expensive preents this Christmas,

NO.	LVL	WDS	CLAUSES
28	2	6	now that their father had died,
29	2	7	leaving them with no means of support
30	2	8	and making their home very quiet and lonely.

Passage 2C

NO.	LVL	WDS	CLAUSES
1	0	6	In trying to shave one morning,
2	1	8	which is always a dismal prospect before breakfast,
3	0	5	I found to my surprise,
4	1	3	on switching on,
5	2	9	that the motor made a most disturbing grating sound
6	3	5	which alarmed me at first.
7	3	8	Indeed, I had never heard its like before.
8	0	8	I took the back of the razor off
9	1	6	to look inside for anything amiss,
10	1	9	when a dozen tiny curlicues of metal fell out
11	2	5	and disappeared into the carpet.
12	0	8	I then showed the razor to a friend,
13	1	7	who knew a lot about such matters,
14	2	6	or so he let others believe.
15	0	12	He said he didn't like the look of the steel fragments,
16	0	7	and then he took the back off,
17	1	10	whereupon some pieces of charred plastic rattled to the floor,
18	2	4	alarming me even more,
19	3	11	because there couldn't have been much left inside by then.
20	0	9	But my friend placed the razor on the table,
21	1	7	where the sunlight glistened on the rust.
22	0	8	He gave me a few words of advice:
23	1	7	I should have found out long ago
24	2	6	how to use an electric razor,
25	2	10	and how to manage without the soap and razor blades
26	3	7	which had had such a deleterious effect.
27	0	4	I walked home disheartened
28	0	9	and went to have a shave in the bathroom,
29	1	10	getting out an old cut-throat with my left hand
30	1	11	and with my right tossing the battery razor through the window.

Passage 3A

NO.	LVL	WDS	CLAUSES
1	0	12	In the beginning, the Thunder God created an island in the sea.
2	1	7	His three sons lived in its mountains:
3	2	9	the Rain God sulked in his mass of clouds,
4	2	10	the Fire God sat in the summit of a volcano
5	2	8	and the Stone God rumbled in a ravine.
6	1	6	The foothills were covered with forests
7	2	4	where many serpents lurked, thinking evil thoughts.
9	1	5	Unicorns appeared on the plains
10	2	11	and ran in swift herds between the river and the forest.
11	3	9	At the river they drank the deep, cool water,
12	3	10	and in the forest they ate roots and wild berries
13	4	8	which sprang like magic from the dark undergrowth.
14	1	9	In a cave by the sea lived a dragon
15	2	6	who came out once a year
16	3	5	to hunt for a mate
17	3	7	and to chase the unicorns and serpents.

NO.	LVL	WDS	CLAUSES
18	1	4	Men too were created.
19	2	8	They built themselves a village of log huts,
20	2	5	and set up a council
21	3	7	which consisted of the oldest and wisest,
22	1	8	to commit to writing the first laws.
23	1	8	A single river descended from the mountain slopes
24	2	6	and ran through forests and plains
25	3	9	to merge with the sea beyond the island's cliffs.
26	1	8	The sky above was often the clearest blue,
27	2	6	but sometimes filled with storm clouds
28	2	11	and at others the black specks of birds could be seen
29	3	29	calling to each other over the sea.
30	0	10	A thousand years hence the island will be entirely destroyed.

<u>Passage 3B</u>

NO.	LVL	WDS	CLAUSES
1	0	6	It was indeed a beautiful house.
2	1	9	The decorators had tried their best with the decor;
3	2	6	each room represented a different period:
4	3	9	one saw classical, Georgian and ultramodern rooms immediately adjacent.
5	1	8	The plumbers had installed a solid silver bath
6	2	8	and connected it to unbelievably quiet water-piping
7	3	3	hidden from sight,
8	3	8	which was to win an important industrial award.
9	2	10	Glittering crystal taps projected from the foot of the bath.
10	1	7	The kitchen had been uniquely fitted out:
11	2	12	one wall housed a deep-freeze the size of a small room,
12	2	7	and the floor was supposedly self-cleaning.
13	1	5	The builders had taken trouble
14	2	4	to enhance the walls
15	3	7	by fusing their surfaces with oxyacetylene torches
16	4	8	so that they acquired a glass-like finish
17	4	6	and by using blue-tinted concrete.
18	1	7	Heating was provided by large ceiling panels
19	3	5	which were no fire hazard
20	1	5	due to their low temperature.
21	1	9	The architects had chosen the site of the house,
22	2	10	and had positioned it carefully in relation to the terrain,
23	3	7	so that it nestled in its landscaping
24	4	8	as a chick snuggles in a hen's nest.
25	2	10	The site also provided the maximum protection from the elements.
26	1	9	The nurserymen had been hired from a botanical gardens,
27	2	6	and they planted many exotic shrubs
28	3	4	distributing them in clusters
29	4	11	so as to lend an almost subtropical air to the setting.
30	0	10	Both bride and groom were overjoyed with their new home.

<u>Passage 3C</u>

NO.	LVL	WDS	CLAUSES
1	0	11	Tempotranspo's time machine has been designed with great attention to detail.
2	1	8	The operator climbs in through a forward hatch
3	2	7	and sits on a plush, ventilated seat.
4	2	8	His feet rest on pedals on the floor:

NO.	LVL	WDS	CLAUSES
5	3	11	the left one can be used as an emergency time-brake,
6	3	10	whereas the right one dissociates the machine from the present.
7	1	7	Passengers climb in through the rear hatch
8	2	6	and sit on equally luxurious seats.
9	3	3	These tip back
10	4	6	if the occupent wishes to sleep.
11	1	12	The time engine itself is located in the middle of the machine
12	2	6	and draws its power from batteries
13	3	5	located in the lower bodywork,
14	3	8	which may be recharged occasionally from the mains.
15	1	9	The bodywork is moulded from a special, laminated plastic
16	2	8	and can resist extremes of heat and cold
17	3	5	without becoming brittle or tarnished.
18	1	9	In front of the pilot is housed the computer,
19	2	4	specially designed by Plessey.
20	2	8	It can control the machine quite automatically,
21	3	7	which relieves the pilot of many responsibilities
22	3	5	and controls travel more accurately.
23	1	7	The superstructure is of an aluminium alloy
24	2	6	and was constructed by Hawker Siddeley.
25	2	9	It is welded to the bodywork and leg struts.
26	1	4	Operation is quite simple
27	2	7	and is described in a detailed handbook.
28	2	10	Alternatively, the intending purchaser may attend a course of lessons
29	3	10	at the end of which he sits for a diploma.
30	0	9	Tempotranspo expect an expanding market for their time machine.

APPENDIX 1.2: EXPERIMENT III: PASSAGES

Passage S

NO.	WDS	CLAUSES
1	5	I felt tired but excited;
2	8	I had spent most of a summer's afternoon
3	7	putting up my battered but camouflaged hide
4	3	and arranging microphones
5	11	to record the mating call of the little-known pied crow.
6	7	Its nest, ... lay a short distance downhill
7	6	... constructed from certain rare fern fronds, ...
8	8	from where I sat in the purple heather,
9	8	looking around at the formations of misty hills.
10	11	I had watched the small, dark male arrive some minutes before,
11	6	and disappear into the female's nest,
12	10	so I expected soon to hear the unique ululating call
13	5	it uttered once a year.
14	4	I had been told
15	10	that no naturalist in England had ever taped it before.
16	7	I set up all my expensive equipment,
17	8	and was about to start the tape-recorder,
18	9	when a beautiful swallow-tail butterfly drifted slowly past,
19	6	wings flashing in the thin sunlight,
20	7	and disappeared over the warm hill-top.
21	5	Straight away, I leapt up
22	8	to catch the insect in my cupped hands;
23	12	but while I was away fom my post for just thirty seconds,
24	10	a melodious warble seemed to turn the breeze to honey,
25	6	and echoed down the valley, unrecorded.
26	7	I looked down at the rare butterfly
27	9	quivering in my palm like two rainbow-coloured leaves,
28	9	and in my dismay it seemed no longer important.
29	4	I let it go,
30	9	and it fluttered off down the valley quite unperturbed.

Passage T

NO.	WDS	CLAUSES
1	12	When little Willy was given a toy car by his Uncle Tom,
2	10	he played with it on the floor for an hour
3	7	before becoming tired of its conventional uses.
4	8	He'd always been a rather inquisitive child,
5	11	and, true to form, prised the top off with a spoon
6	3	to look inside.
7	11	All those cogs and rods musty have stimulated his curiosity further,
8	4	for, besides watching them,
9	7	he prodded them with a fat fore-finger.
10	6	Unfortunately, his finger got stuck fast
11	5	and he began to cry.
12	8	His mother was cooking dinner at the time
13	6	and came running from the kitchen.
14	8	She saw immediately what the boy had done,
15	7	but was unable to extricate his finger.
16	8	Then Tom ran in from the back garden,
17	5	and burst into loud laughter:
18	10	he had once done a similar thing as a boy,
19	9	but he still couldn't free poor Willy's finger.
20	6	His mother, in desperation, suggeted pliers,

NO.	WDS	CLAUSES
21	9	and went to fetch a pair from the garage.
22	10	Tom then began to clip away the pieces of metal
23	4	which held Willy fast,
24	7	and very soon the toy fell apart,
25	9	and the boy's finger emerged, apparently none the worse.
26	9	But Willy kept on crying, not about his finger,
27	8	but because the car now lay in pieces.
28	7	His uncle patted him on the head,
29	6	and his mother, smelling something strange,
30	5	dashed back into the kitchen.

APPENDIX 1.3: EXPERIMENT IV: PASSAGES

Passage P: beginning 'e' (version Pe)

NO.	WDS	CLAUSES
1	9	One morning, John's father sent him on a errand.
2	12	He had to collect a parcel of clothes from his Uncle Bert
3	7	and deliver them to his grandmother's shop,
4	5	so she could sell them
5	7	to raise money for the parish church.

Passage P: beginning 'a' (versions Pi and Pa)

NO.	WDS	CLAUSES
1	7	One morning, John woke up, very excited.
2	12	He had planned to collect blackberries with some friends from the village,
3	7	but his delight was only shot-lived:
4	5	his father searched him out
5	9	and gave him some other work to do instead.

Passage P: ending 'e' (versions Pe and Pi)

NO.	WDS	CLAUSES
26	9	and his grandmother had seen John below, all dishevelled.
27	5	She had been expecting him,
28	8	and already knew of his uncle's clothes parcel.
29	7	"The vicar will be delighted," she said,
30	10	"with all the money we'll raise from these clothes,"

Passage P: ending 'a' (version Pa)

NO.	WDS	CLAUSES
26	9	and some white curtains were flapping in the breeze.
27	8	Beyond an iron gate lay a muddy stream.
28	10	John hid the mysterious parcel behind a row of bushes,
29	5	and, taking off his sandals,
30	7	he waded across to the other bank.

Passage P: central section (all versions)

NO.	WDS	CLAUSES
6	4	John left the house;
7	6	it was a fine sunny day
8	8	and he decided to take a favourite path
9	7	which wound through some woods and fields,
10	9	coming to an end at the village of Clifford.
11	9	At last he stopped in the village, very thirsty,
12	11	and drank cool water from a tap in the market place.
13	3	It was Sunday,
14	7	and the village streets were almost deserted.
15	11	Saturday's market had left its usual residue of paper and vegetables,
16	8	around which buzzed the occasional wasp or fly.
17	8	Uncle Bert's house fronted on to the square.
18	6	Its windows were shuttered and silent,
19	10	but a bulky brown paper package lay on the doorstep.
20	4	John picked it up
21	6	and set off through the village.

NO.	WDS	CLAUSES
22	5	Church bells tolled sleepily nearby.
23	10	At the end of a lane was his grandmother's shop.
24	8	Here too blinds still covered the downstairs windows,
25	6	but the upstairs windows were open,

<u>Passage Q: beginning 'e' (version Qe)</u>

NO.	WDS	CLAUSES
1	7	Ben Alreth got to his feet slowly.
2	8	He was now one of the King's knights
3	7	and had only to pass a test
4	9	before being allowed to move into his own castle.
5	11	The King had asked him to rescue one of his daughters,

<u>Passage Q: beginning 'a' (versions Qi and Qa)</u>

NO.	WDS	CLAUSES
1	7	Ben Alreth was a handsome young Arab
2	8	who trained horses for the King of Persia.
3	9	After thus spending many years in the King's service,
4	7	he became bored with a routine life.
5	11	One fine April day, the King gave him a month's holiday,

<u>Passage Q: ending 'e' (versions Qe and Qi)</u>

NO.	WDS	CLAUSES
26	12	At the back of the hermit's cave, Princess Izdril was still asleep.
27	10	Ben Alreth loosed the straps round her hands and feet,
28	6	kissed her smiling rose-red lips,
29	8	and rode back with her to the King.
30	10	He passed by his newly-won castle on the way.

<u>Passage Q: ending 'a' (version Qa)</u>

NO.	WDS	CLAUSES
26	10	Ben Alreth buried the gnarled body in a shallow grave,
27	6	and continued sadly on his journey.
28	12	By nightfall he had reached the other side of the mountain range,
29	8	and looked out over a dark, endless plain
30	10	which he would see for the first time at sunrise.

<u>Passage Q: central section (all versions)</u>

NO.	WDS	CLAUSES
6	9	so Ben Alreth climbed on to his white horse
7	6	and rode off into the mountains.
8	10	when night fell, he lit a fire near some rocks
9	3	and cooked food
10	5	the Queen had given him.
11	8	Then he took the blanket from his saddle
12	9	and went to sleep in it on the ground.
13	9	The morning sun was already over the mountains
14	5	when Ben Alreth woke up.
15	4	His horse trotted over,

NO.	WDS	CLAUSES
16	5	and he saddled up immediately.
17	11	The track up to the mountain hermitage was steep and narrow,
18	8	but just after midday he found a cave.
19	7	A fierce-looking man with a beard leapt out,
20	7	and shouted in a guttural foreign tongue.
21	4	Ben Alreth jumped down
22	6	and drew his fine old sword.
23	7	The hermit attacked him with an axe,
24	7	but Ben Alreth was an unbeaten fighter,
25	6	and the hermit was soon slain.

APPENDIX 1.4: EXPERIMENT V: PASSAGE F AND ORIGINAL STORY

Passage F

NO.	WDS	CLAUSES
1	6	There once was a old farmer
2	10	who lived on a small sleepy farm in the country.
3	4	It was pleasant farm
4	13	nestling among grassy fields and wide meadows, with a shed and a greenhouse.
5	8	Now, this farmer owned a very stubborn donkey,
6	4	which passed the day
7	8	lazily grazing in a field behind the farm.
8	8	One evening the farmer was trying as usual
9	10	to persuade the donkey into its tumble-down wooden shed.
10	4	First, he pulled it,
11	6	but the donkey wouldn't move.
12	5	Then he pushed the beast,
13	6	but it still refused to move.
14	6	The farmer was an old widower
15	11	who had lived among these meadows and fields all his life,
16	9	but he found that he tired easily these days.
17	6	Fortunately, an idea ... occurred to him.
18	7	... for making the donkey enter its shed ...
19	8	Going round to the back of the shed,
20	10	he found his dog, a golden retriever of placid disposition,
21	4	sleeping by the greenhouse.
22	6	Politely, the farmer asked the dog
23	6	to bark loudly at the donkey
24	8	and try to frighten it into the shed,
25	4	but the dog refused.
26	6	Returning to the red-brick farmhouse,
27	9	which looked so sleepy amid its lush green fields,
28	15	the farmer next asked his cat, a ginger tom with a couple of war-wounds,
29	4	to scratch the dog;
30	7	he knew this would make it bark.
31	4	However, the cat, ... replied:
32	11	... also lazing in the evening sunlight, on the kitchen window-ledge, ...
33	8	"I would gladly scratch the dog for you
34	11	if only you would get me a saucer of milk first."
35	12	So finally, the farmer sought out his cow in the local meadow
36	5	and asked for some milk.
37	10	The light brown Jersey cow looked him in the eye
38	3	and nodded sympathetically:
39	7	this sequence of events happened every evening.
40	7	The cow gave the farmer the milk
41	2	he wanted
42	10	and the farmer brought the milk back to the farmhouse,
43	6	put it in a china saucer
44	6	and gave it to the cat.
45	12	As soon as the cat had licked up the fresh warm milk,
46	7	it climbed down off the window-ledge,
47	5	went out to the greenhouse
48	7	and began to scratch the dog's ear.
49	7	This made the dog bark so loudly
50	5	that the donkey took fright
51	6	and jumped straight into its shed.

NO.	WDS	CLAUSES
52	5	The farmer bolted the door
53	6	and heaved another sigh of relief.
54	8	The cat returned to its life of leisure
55	9	and the farm settled down to another August night.

"The Old Farmer and his Stubborn Animals"

Original version of the passage, taken from Thorndyke (1975a: 153).

There once was a old farmer who owned a very stubborn donkey. One evening the farmer was trying to put his donkey into its shed. First, the farmer pulled the donkey, but the donkey wouldn't move. Then the farmer pushed the donkey, but the donkey still wouldn't move. Finally, the farmer asked his dog to bark loudly at the donkey and thereby frighten him into the shed. But the dog refused. So then, the farmer asked his cat to scratch the dog so the dog would bark loudly and thereby frighten the donkey into the shed. But the cat replied, "I would gladly scratch the dog if only you would get me some milk." So the farmer went to his cow and asked for some milk to give to the cat. But the cow replied, "I would gladly give you some milk if only you would give me some hay." Thus, the farmer went to the haystack and got some hay. As soon as he gave the hay to the cow, the cow gave the farmer some milk. Then the farmer went to the cat and gave the milk to the cat. As soon as the cat got the milk, it began to scratch the dog. As soon as the cat scratched the dog, the dog began to bark loudly. The barking so frightened the donkey that it jumped immediately into its shed.

APPENDIX 2.1: MARKING STUDY: INSTRUCTIONS SUPPLIED TO JUDGES

Attached to these instructions you will find a prose passage and the recall versions of seven subjects. The purpose of this study is to see how well my marking of these versions can be duplicated by independent markers, so as to find out how reliable the marking criteria are. Marking consists of underlining in different colours the verbatim and intrusive components of recall scripts, the remainder being 'nonverbatim'. Criteria for this are given below. You should fill in by the boxes after each script the total number of words (W), the number of words of verbatim recall (V), the number of words of intrusions (I), and the number of words of nonverbatim material (X, obtained by subtracting V and I from W). Although you only mark for two of the three components, criteria for all three are given to help in borderline cases. You may make notes on points of difficulty at the bottom of the sheets.

Criteria

1) Words recalled verbatim (V): more or less in the same place for the same meaning as the identical words in the original. Fairly radical shifts in position may be allowed for words occurring only once originally.

2) Words recalled nonverbatim (X): not recalled verbatim but corresponding to material in the original passage, not necessarily on a word-for-word basis. Changes of meaning may sometimes be drastic, but some obvious derivation from the passage should be retained.

3) Intrusions (I): reproduced material not appearing, or corresponding to any appearing, in the original passage. Include repetitions of material already counted as recalled, but occurring only once originally.

Notes

You should interpret these definitions fairly strictly and as consistently as you can. You will probably need to make a number of arbitrary decisions of your own. Stick to these throughout, and try to make them compatible with the spirit of the above criteria. In borderline cases, give the benefit of the doubt to the subject, ie count X or V as V, I or X as X, failing all else.

APPENDIX 2.2: MARKING STUDY: RECOMMENDED WORD-SCORE MARKING CRITERIA

Preliminary examination

1) Scripts are checked through to exclude non-textual notes or asides and all but the first item from sets of alternatives, except where this would create inconsistencies, when a later item may be chosen. Subjecs own amendments are always allowed to stand.

2) Obviously omitted words may be restored using only the minimum number of words required to retore grammatical sense; this will not normally involve nouns, adjectives or main verbs.

3) Similarly, genuine and apparently unintentional errors of grammar or spelling should be corrected.

4) Abbreviations and symbols are replaced by the full word, except for the standards "ie", "eg", "etc". Certain contractions (eg "-'ll", "-n't") are retained.

5) All such alterations are regarded as if the subject had made them himself.

Total words - W

1) W is obtained by counting all the words remaining in a script afer the preliminary examination.

2) Hyphenated compound words formed from actual words count as two words.

3) Abbreviations and symbols, where restored, and contractions are counted as the number of words in the full form.

Verbatim recall - V

1) V is obtained by counting all the words in a script (as restored) which are exactly the same as corresponding ones in the original passage.

2) Spelling variants are usually scored 'V'.

3) Isolated words, including articles, conjunctions and pronouns are scored 'V' even if part of a phrase not otherwise verbatim.

4) Original contractions must be recalled in contracted form to be scored 'V'.

5) A degree of transposition at recall may be tolerated for verbatim scoring, especially for words occurring only once originally.

6) In unresolved borderline cases, a word should be scored 'V' rather than 'X' or 'I'.

Intrusions - I

1) Intrusions are scored by counting all the words in a script which do not correspond to or derive from material in the original passage.

2) Repetitions are items occurring twice or more in a script but corresponding to only one original item. Only the most accurate instance, or that occurring closest to the original location, may be scored 'V' or 'X', others are intrusive.

3) Isolated words may be scored 'I' unless part of a change in expression. Conjunctions are normally only intrusive when part of an intrusive phrase. Pronouns are not intrusive when substituting for an original 'implicit' pronoun.

4) Substitution of a word or phrase for a pronoun is not scored 'I' where it is kept to the minimum number of words necessary. Extra words are scored 'I'.

5) In unresolved borderline cases, an item is scored 'V' or 'X' rather than 'I'.

Nonverbatim recall

1) Nonverbatim recall is scored by subtracting V and I from W, though some additional comments may help the identification of verbatim and intrusive material.

2) Slight variations from verbatim recall, where pronunciation is affected, are scored 'X'.

3) Roughly synonymous substitutions, including expansions, are scored 'X'.

4) Substitutions of related or derivative meaning, even remote or antonymous ones, are scored 'X'.

5) Words involved in changes of expression but not themselves substitutions are scored 'X'.

General comments

1) A general principle of conservatism operates in borderline cases, giving the benefit of the doubt to the more accurate alternative.

2) 'Implicit' pronouns are instances where neither pronoun nor noun phrase accompanies a verb, but where a pronoun at least is implied and 'understood' by the context.

3) Judges in the marking study were all prone to some inconsistency in applying the scoring criteria, and to errors of both inclusion and exclusion. Great care is essential in any marking exercise of the present kind.

APPENDIX 2.3: EXPERIMENT I: ALLOCATION OF SUBJECTS TO CONDITIONS

	Subject No.	Session - Trial 1-1	1-2	1-3	2-1	2-2	2-3	3-1	3-2	3-3
	1	2C	3A	1B	3B	1C	2A	1A	2B	3C
	3	3C	1B	2A	1A	2C	3B	2B	3A	1C
	5	2B	3C	1A	3A	1B	2C	1C	2A	3B
Latin	6	1C	2A	3B	2B	3C	1A	3A	1B	2C
square	8	1B	2C	3A	2A	3B	1C	3C	1A	2B
no.1	10	3A	1C	2B	1B	2A	3C	2C	3B	1A
	15	2A	3B	1C	3C	1A	2B	1B	2C	3A
	16	3B	1A	2C	1C	2B	3A	2A	3C	1B
	17	1A	2B	3C	2C	3A	1B	3B	1C	2A
	2	2B	3A	1	3C	1B	2A	1A	2C	3B
	4	3B	1C	2A	1A	2B	3C	2C	3A	1B
	7	3A	1B	2C	1C	2A	3B	2B	3C	1A
Latin	9	3C	1A	2B	1B	2C	3A	2A	3B	1C
square	11	2C	3B	1A	3A	1C	2B	1B	2A	3C
no. 2	12	1C	2B	3A	2A	3C	1B	3B	1A	2C
	13	1A	2C	3B	2B	3A	1C	3C	1B	2A
	14	1B	2A	3C	2C	3B	1A	3A	1C	2B
	18	2A	3C	1B	3B	1A	2C	1C	2B	3A

APPENDIX 2.4: EXPERIMENT II: ALLOCATION OF SUBJECTS TO CONDITIONS

Condition	Latin square	Subject no.	Order of Passages			Latin square	Subject no.	Order of Passages		
Liberal	1:	12	1A	2C	3B	3:	21	1A	3B	2C
		34	2C	3B	1A		15	3B	2C	1A
		30	3B	1A	2C		33	2C	1A	3B
	2:	4	2C	1A	3B	4:	17	3B	1A	2C
		27	3B	2C	1A		31	1A	2C	3B
		1	1A	3B	2C		10	2C	3B	1A
Normal	5:	22	1A	3B	2C	7:	24	2C	3B	1A
		20	2C	1A	3B		25	3B	1A	2C
		28	3B	2C	1A		19	1A	2C	3B
	6:	9	2C	3B	1A	8:	6	3B	2C	1A
		11	1A	2C	3B		5	2C	1A	3B
		16	3B	1A	2C		13	1A	3B	2C
Precise	9:	29	1A	2C	3B	11:	35	2C	1A	3B
		32	3B	1A	2C		8	1A	3B	2C
		14	2C	3B	1A		26	3B	2C	1A
	10:	7	3B	2C	1A	12:	18	3B	1A	2C
		23	1A	3B	2C		36	2C	3B	1A
		3	2C	1A	3B		2	1A	2C	3B

APPENDIX 2.5: EXPERIMENT II: RECALL INSTRUCTIONS

'Precise' instructions (P)

Now, I want you to write out as much of the passage as you can remember, in prose rather than note form. I am principally interested in accuracy of recall, so you must take particular care over the details and wording of what you write down. Don't write down any details unless you are reasonably sure of their accuracy and correct sequence. Wherever possible, you should try to use the wording of the original passage. Take your time over this: there's no need to hurry, and rushing may cause you to omit details you would otherwise remember, or make errors of fact or phrasing. Check your account through carefully when you have finished, making corrections, additions or footnotes as you wish. Spelling and punctuation don't matter. Are there any questions? Right, begin when you are ready. Remember, take your time, and it's accuracy that counts.

'Normal' instructions (N)

Now, I want you to write down as much of the passage as you can remember, in prose rather than note form. I am not interested in the exact words used originally, but if you do happen to remember them, so much the better. Take your time over this, there's no need to hurry. If there is anything you remember you are not sure about, underline it in your account. Check through what you have written when you have finished, making corrections, additions or footnotes as you wish. Spelling and punctuation don't matter. Are there any questions? Right, begin when you are ready.

'Liberal' instructions (L)

Now, I want you to write out as much of the passage as you can remember, in prose rather than note form. I am interested principally in how much you can remember, even if what you recall is not particularly accurate, although accuracy should still be a subsidiary consideration. I am not interested in the exact words used originally, but if you do happen to remember them, so much the better. If you think there is a gap in your memory, ie a word or phrase or section missing, try to put something in even if it means making an educated guess. Similarly, it is always better to put down something you are not sure about than to leave it out altogether. Take your time over this, there's no need to hurry. Check your account through carefully when you have finished, making corrections, additions or footnotes as you wish. Spelling and punctuation don't matter. Are there any questions? Right, begin when you are ready, and let me know you've finished.

APPENDIX 2.6: RATING STUDY: EXPLANATORY MATERIAL

Ratings of clause from passages

There follows a questionnaire in which you are asked to rate a number of excerpts from three passages on a number of scales. Its purpose is to obtain an objective assessment of them to compare with how they are recalled in a memory experiment on story-like material.

Before you begin the passages, you should familiarise yourself with the scales used. For each there is a general description and a graded list of attributes corresponding to the seven points of each scale. You may find it helpful to continually refer back to these during the procedure, and for this purpose they are presented on a separate set of sheets.

Then you should read each passage through before attempting to rate any of its clauses, since many scales require a judgement of a clause in relation to the rest of the passage. Label each sheet in the space provided with the number of the passage, and label each block of nine scales with the clause they refer to. For each scale for each clause ring the item you think most closely corresponds to your opinion. 'DK' means you don't know which value to ring, and 'NA' means you think the scale is not applicable to the clause you are trying to judge. But don't use either except as a last resort. Don't spend too long over each item, but on the other hand, try not to be too hasty either. Notice that the value '4' is always the midpoint (generally speaking, the average) of each scale.

The Rating Scales

Scale One: Intrinsic information content

This is a quantitative measure. Do not take account of (correct for) the physical size of the clause (in words), nor of its relations with the other clauses or the passage as a whole.

1 contains practically no information whatsoever

2 contains only a little information: quite a lot less than the average

3 contains a little less information than average

4 contains an average amount of information for clause in the passage

5 contains a little more information than average

6 contains quite a lot more information than average

7 contains very much more information than average: could scarcely contain any more

Scale Two: Repetitiveness

The extent to which a clause repeats information given elsewhere in the passage, whether occurring before or after it. Repetition need not be in the exact words of the original - rough synonyms may count as well.

1 almost wholly a repeat of information given elsewhere

2 mostly a repeat of information given elsewhere, much more so than average

3 repeats information given elsewhere, a little more than average

4 repeats some information, but only to an average extent

5 repeats some information, but less than average

6 repeats a little information, but much less than average

7 repeats no information at all.

Scale Three: Inferability from Context

The extent to which the information contained in a clause can be inferred from the rest of the passage (before or after the clause), or to which it would be assumed if the clause had been omitted. While repetitiveness tends to imply inferability from context, the converse is not necessarily so. A clause may be completely inferable from the rest of the passage yet not actually repeat any of it.

1 information content may be completely inferred from the rest of the passage

2 adds only a little to passage: most of content may be inferred

3 adds only moderately to passage: content may be inferred a little more than average

4 some information content may be inferred from rest of passage, but only to an average extent

5 content may be inferred a little less than average

6 content may be inferred to a small extent only, much less than average

7 content cannot be inferred at all from the rest of the passsage

Scale Four: Congruity with Context

The extent to which the information in the clause fits in with the rest of the passage, especially with the main story-line. Congruity should be kept distinct from inferability: whereas a clause which may be inferred from the rest of the passage will probably fit in quite well, other clauses may fit in very well, yet not be inferable in any way.

1 entirely congruent: fits as well as possible into passage

2 fits very well: much better than average

3 fits well: a little better than average

4 fits quite well into passage: neither better nor worse than average

5 fits fairly well into passage: a little worse than average

6 does not fit very well: much worse than average

7 totally incongruent: does not fit into passage at all

Scale Five: Essentialness to Story-line

The extent to which the clause is necessary to the main story-line, idea or plot. Alternatively it is also the extent to which the story-line would suffer or be less complete or coherent were the clause to have been omitted. This is to be understood as a diffrent quality from either inferability or congruity.

1 entirely essential: passage would lose seriously if clause were omitted

2 quite essential: much more than average

3 essential: a little more than average

4 essential: but only to an average extent

5 essential in many ways: a little less than average

6 essential in some ways: much less than average

7 quite dispensible: passage would lose nothing important if clause were omitted

Scale Six: Narrative-Descriptive Nature

For this scale, clauses are taken to lie somewhere on a continuum from being wholly narrative to being wholly descriptive, the two properties being assumed to be mutually exclusive in many ways. For a clause to occupy a middle rating (average position) it need not necessarily contain two dissimilar elements, but only one whose identity places it near neither extreme of the scale. 'Narrative' clauses are very much concerned with 'plot' or activity - things happening. 'Descriptive' clauses are more concerned with describing story-elements or setting scenes. It is a different scale from 'essentialness to story-line', neither extreme implying any particular position on this scale.

1 wholly narrative: concerned only with activities happening and containing no descriptive elements

2 mostly narrative: only a small descriptive element

3 predominantly narrative: but with a significant descriptive element

4 neither largely descriptive nor largely narrative: an 'average' sort of clause in these respects

5 predominantly descriptive: but with a significant narrative element

6 mostly descriptive: only a small narrative element

7 wholly descriptive: concerned only with the appearances or properties of things or with setting scenes

<u>Scale Seven: Unusualness</u>

The extent to which a clause is surprising, unexpected or peculiar, either within its context or because of its information content (ie intrinsically). The unusualness of any given clause need not necessarily be related to either its inferability from context or its congruity with context.

1 highly unusual: could scarcely be less ordinary

2 quite unusual: much more than average

3 slightly unusual: a little more than average

4 neither especially unusual nor especially ordinary: about average in these respects

5 ordinary: a little more than average

6 quite ordinary: much more than average

7 very ordinary indeed: could scarcely be less unusual

<u>Scale Eight: Interestingness</u>

The extent to which the clause is interesting or embodies some element of information which attracts interest or attention. Interest is meant in either sense of being intrinsic (contained information alone) or contextual (ie in relation to other clauses or passage as a whole). Also, interestingness should be seen as separate from unusualness, although the two scales are probably not wholly unrelated.

1 very interesting indeed: could scarcely be less dull

2 quite interesting: much more than average

3 interesting: a little more than average

4 neither especially interesting nor especially dull: about average in these respects

5 dull: a little more than average

6 quite dull: much more than average

7 very dull indeed: could scarcely be less interesting

<u>Scale Nine: Difficulty of Comprehension</u>

The extent to which the clause is difficult to understand, perhaps because of its own content, but more especially because of its relations to the other clauses of the passage or the passage as a whole. Simply because a clause is difficult to understand in its relations to the passage, it does not follow that it does no fit into the passage. Difficulty of comprehension and congruity with context must be treated as independent qualities.

1 quite incomprehensible: could not be more difficult to understand

2 very difficult to understand: much more than average

3 somewhat difficult to understand: a litle more than average

4 neither particularly easy nor particularly difficult to understand: of average comprehensibility

5 somewhat easy to understand: a little more than the average

6 very easy to understand: much more than average

7 perfectly comprehensible: coould not be easier to understand

APPENDIX 2.7: EXPERIMENT IV: PRESENTATION ORDER OF PASSAGES

Subject No.	Order of present-ation	Subject No.	Order of present-ation	Subject No.	Order of present-ation
1	Pi Qa	13	Pe Qi	25	Qe Pa
2	Pe Qi	14	Pa Qi	26	Qi Pa
3	Qi Pe	15	Pa Qi	27	Qe Pi
4	Pe Qa	16	Qi Pa	28	Pe Qa
6	Pa Qe	18	Qi Pe	30	Qi Pe
7	Qa Pe	19	Pe Qa	31	Pi Qa
8	Qi Pa	20	Qe Pi	32	Qa Pe
9	Pa Qi	21	Qi Pa	33	Pa Qe
10	Qe Pa	22	Pi Qe	34	Pi Qe
11	Qe Pi	23	Qe Pa	35	Qa Pi
12	Pi Qe	24	Pa Qe	36	Pe Qi

APPENDIX 3.1: MARKING STUDY: RAW DATA

Variable		Script no.	Judge 1	Judge 2	Judge 3	Experi-menter 1	Experi-menter 2
	(	1	106	110	109	111	111
	(	11	134	137	134	137	136
	(	17	149	149	147	150	149
W	(	16	152	170	179	173	172
	(	2	164	175	174	177	177
	(	15	206	202	211	202	202
	(	3	224	223	223	224	224
	(	1	18	33	36	43	45
	(	11	27	38	41	61	63
	(	17	10	34	46	61	66
V	(	2	51	75	80	86	94
	(	16	84	101	108	107	108
	(	3	96	127	139	135	140
	(	15	114	139	147	147	145
	(	15	88	59	50	44	45
	(	17	117	70	43	44	46
	(	11	93	67	47	46	46
X	(	16	67	59	36	54	50
	(	1	88	74	49	61	64
	(	3	124	90	73	69	63
	(	2	108	95	58	80	71
	(	1	0	3	24	7	2
	(	2	5	5	36	11	12
	(	15	4	4	14	11	12
I	(	16	1	10	35	12	14
	(	3	4	6	24	20	21
	(	11	14	32	46	30	27
	(	17	22	45	58	45	37

APPENDIX 3.2: EXPERIMENT I: RAW DATA

Clause recall

Subject	Passage 1A	1B	1C	2A	2B	2C	3A	3B	3C
1F	25	21	21	24	20	21	18	19	16
2F	28	25	22	27	24	27	26	27	22
3F	27	30	26	27	30	29	26	27	20
4M	28	27	23	28	29	20	24	22	25
5M	21	22	22	25	20	29	25	25	25
6M	25	27	19	24	26	26	22	28	29
7F	26	24	24	29	29	26	20	27	25
8M	27	20	21	22	22	24	19	23	17
9M	19	24	22	17	19	20	20	24	11
10F	24	18	19	21	24	23	23	28	20
11F	26	25	14	22	20	18	9	16	19
12M	26	22	17	13	21	22	17	15	17
13F	23	23	13	12	23	26	16	16	19
14M	25	27	26	27	30	26	26	24	26
15F	28	28	24	26	29	30	26	27	28
16M	29	28	26	26	25	19	18	22	20
17F	19	26	27	27	27	24	30	28	20
18M	30	29	27	20	30	28	29	29	25

Total words - W

Subject	Passage 1A	1B	1C	2A	2B	2C	3A	3B	3C
1F	147	125	128	135	133	111	113	110	131
2F	187	178	163	162	186	177	152	160	153
3F	194	232	192	211	220	224	202	181	143
4M	163	172	150	164	191	130	141	141	199
5M	138	132	182	172	135	190	177	175	161
6M	205	199	143	186	195	198	190	192	220
7F	169	162	159	209	211	188	138	196	161
8M	185	147	157	151	173	176	139	160	125
9M	104	167	131	92	133	144	121	143	73
10F	164	105	156	117	136	156	141	184	131
11F	161	181	119	170	167	137	60	128	141
12M	147	146	108	63	138	140	95	98	138
13F	147	172	91	87	155	167	113	111	140
14M	167	153	179	169	186	160	158	154	171
15F	196	203	193	196	212	202	189	199	215
16M	200	202	185	166	156	173	140	155	170
17F	129	191	177	184	186	150	211	181	151
18M	235	196	199	116	216	198	199	211	176

Verbatim recall - V

Passage

Subject	1A	1B	1C	2A	2B	2C	3A	3B	3C
1F	70	80	75	60	73	43	87	62	84
2F	128	101	100	95	107	86	99	102	79
3F	116	137	107	137	155	135	144	133	84
4M	83	81	75	77	83	68	99	44	93
5M	64	66	100	67	40	109	97	91	64
6M	121	123	51	115	92	120	119	123	116
7F	108	100	90	107	112	101	83	108	96
8M	102	84	89	63	87	96	95	96	63
9M	47	98	63	35	57	92	68	69	43
10F	104	50	73	72	73	93	93	105	77
11F	78	90	52	77	66	61	31	49	46
12M	77	82	45	23	44	73	67	41	58
13F	65	114	44	47	76	96	57	66	70
14M	108	91	111	80	125	104	107	83	97
15F	138	128	116	104	133	147	157	124	148
16M	128	107	92	61	85	107	79	68	87
17F	61	122	84	91	89	61	121	94	81
18M	147	123	146	73	142	131	157	132	124

Nonverbatim recall - X

Passage

Subject	1A	1B	1C	2A	2B	2C	3A	3B	3C
1F	43	43	44	54	39	61	21	33	38
2F	44	56	49	51	66	80	40	48	58
3F	56	77	59	53	56	69	42	38	41
4M	74	63	52	66	80	44	35	71	82
5M	51	48	47	81	58	62	61	53	76
6M	53	48	81	51	75	67	56	46	62
7F	57	41	57	80	85	64	44	66	56
8M	78	39	59	74	70	69	42	50	37
9M	53	46	58	49	67	48	52	62	23
10F	46	47	63	37	53	50	43	64	49
11F	54	70	39	72	70	46	25	41	61
12M	40	39	46	35	83	54	26	41	57
13F	44	46	37	32	62	58	44	41	52
14M	45	46	63	58	57	42	40	63	59
15F	53	52	59	62	75	44	32	56	52
16M	55	62	63	81	63	54	50	63	48
17F	62	55	75	68	73	44	65	69	49
18M	66	62	52	35	69	53	38	64	42

Intrusions - I

Passage

Subject

	1A	1B	1C	2A	2B	2C	3A	3B	3C
1F	34	2	9	21	21	7	5	15	9
2F	15	21	14	16	13	11	13	10	16
3F	22	18	26	21	9	20	16	10	18
4M	6	28	23	21	28	18	7	26	24
5M	23	18	35	24	37	19	19	31	21
6M	31	28	11	20	28	11	15	23	42
7F	4	21	12	22	14	23	11	22	9
8M	15	24	9	14	16	11	2	14	15
9M	4	23	10	8	9	4	1	12	7
10F	14	8	20	8	10	13	5	15	5
11F	29	21	28	21	31	30	4	38	34
12M	30	25	17	5	11	13	2	16	23
13F	38	12	10	8	17	13	12	4	18
14M	14	16	5	31	4	14	11	8	15
15F	5	23	18	30	4	11	0	19	15
16M	17	33	30	24	8	12	11	24	35
17F	26	14	18	25	24	45	25	18	21
18M	22	11	1	8	5	14	4	15	10

APPENDIX 3.3: EXPERIMENT II: RAW DATA

	Score:	W			V			X			I		
	Passage:	1A	2C	3B	1A	2C	3B	1A	2C	3B	1A	2C	3B
Instr-uctions	Subj. no.												
(	2	108	129	135	45	50	65	53	57	51	10	22	19
(	3	118	155	169	70	82	74	34	57	80	4	15	15
(	7	139	134	51	73	56	18	54	65	25	12	13	8
(	8	134	151	113	71	97	52	51	50	52	12	4	9
(	14	132	115	120	75	66	73	46	46	38	11	3	9
P (	18	157	154	103	77	91	39	65	56	39	15	7	25
(	23	96	155	111	43	73	65	41	62	38	12	20	8
(	26	168	150	120	102	86	79	56	56	38	10	8	3
(	29	139	146	179	57	86	119	50	45	49	32	15	11
(	32	138	120	102	81	73	47	49	36	40	8	11	15
(	35	147	163	188	106	97	151	36	60	33	5	6	4
(	36	40	111	70	18	41	31	17	55	29	5	25	10
(	5	213	170	177	139	101	115	59	53	57	15	16	5
(	6	98	87	37	60	40	17	33	42	19	5	5	1
(	9	208	152	189	106	69	84	75	66	76	9	10	3
(	11	80	136	158	36	78	101	35	48	54	9	10	3
(	13	125	173	107	58	73	59	52	62	44	15	38	4
N (	16	194	169	63	75	86	33	89	65	19	30	18	11
(	19	89	154	146	38	68	72	38	70	61	13	16	13
(	20	107	98	128	75	25	83	31	61	40	1	12	5
(	22	95	201	62	46	103	32	34	75	28	15	23	2
(	24	167	132	215	93	47	97	52	66	84	22	19	34
(	25	104	119	102	72	73	56	32	40	47	0	6	9
(	28	145	139	174	99	69	85	45	59	72	1	11	17
(	1	145	196	174	50	107	95	71	62	63	24	27	16
(	4	172	136	168	87	56	86	73	60	65	12	20	17
(	10	111	133	125	53	42	50	43	66	63	5	25	12
(	12	220	214	188	90	116	87	94	64	82	36	34	19
(	15	159	163	102	94	83	46	50	61	49	15	19	7
L (	17	160	188	122	98	110	54	56	70	50	6	8	18
(	21	114	167	135	45	49	70	48	76	46	21	42	19
(	27	197	218	125	87	95	38	78	71	51	32	52	36
(	30	132	174	104	69	88	48	50	65	50	13	21	6
(	31	171	144	185	95	88	106	65	36	67	11	10	12
(	33	168	123	153	71	32	52	70	56	79	27	35	22
(	34	161	142	148	80	54	59	63	67	68	18	21	21

APPENDIX 3.4: EXPERIMENT III: RAW DATA

Session 1

Passage	Reading order	Subject no.	Score W	Score V	Score X	Score I
S	First	1	174	71	74	29
		2	141	60	51	30
		15	177	88	62	27
		16	121	55	48	18
		17	149	76	49	24
		18	121	51	46	24
		31	139	46	63	30
		32	99	41	43	15
	Second	3	169	80	58	31
		4	157	96	45	16
		13	151	68	52	31
		14	158	59	50	49
		19	88	46	32	10
		20	101	37	43	21
		29	172	118	40	14
		30	124	64	44	16
T	First	7	151	68	76	7
		8	226	124	60	42
		9	195	106	59	30
		10	209	85	79	45
		23	187	84	85	18
		24	191	75	71	45
		25	211	99	80	32
		26	194	103	64	27
	Second	5	154	82	57	15
		6	182	74	80	28
		11	207	121	60	26
		12	171	86	54	31
		21	190	108	58	24
		22	190	83	78	29
		27	162	69	82	11
		28	155	72	69	14

Session 2

Recalled (Recalled (Second Subject

Condition			Passage S: Subject	Word-scores W	V	X	I	Passage T: Subject	Word-scores W	V	X	I
Recalled before	Recalled first	Read first	1	127	51	51	25	8	230	100	67	63
			16	106	45	43	18	9	202	93	66	43
			17	141	68	40	33	24	195	77	77	41
			32	111	48	51	12	25	178	71	78	29
		Read second	3	149	62	63	24	6	226	55	96	75
			14	157	39	64	54	11	191	107	70	14
			19	102	45	34	23	22	177	72	73	32
			30	124	60	50	14	27	153	68	70	15
	Recalled second	Read first	2	152	59	56	37	7	123	63	49	11
			15	166	73	72	21	10	189	66	89	34
			18	137	41	49	47	23	166	67	86	13
			31	150	56	54	40	26	191	92	80	19
		Read second	4	140	61	63	16	5	76	24	46	6
			13	126	36	54	36	12	166	71	74	21
			20	170	36	72	62	21	185	99	63	23
			29	156	68	56	32	28	123	55	52	16
Recalled before	Recalled first	Read first	5	79	14	40	25	4	98	47	49	2
			12	125	24	66	35	13	114	33	43	38
			21	126	39	56	31	20	110	37	35	38
			28	69	12	30	27	29	99	34	38	27
		Read second	7	66	12	45	9	2	165	39	57	69
			10	203	41	68	94	15	147	47	65	35
			23	167	21	67	79	18	117	39	47	31
			26	127	27	66	34	31	208	62	76	70
	Recalled second	Read first	6	182	34	73	75	3	86	21	41	24
			11	150	67	54	29	14	121	23	40	58
			22	57	10	36	11	19	45	28	13	4
			27	81	28	35	18	30	89	27	47	15
		Read second	8	180	67	65	48	1	73	19	20	34
			9	182	54	66	62	16	39	14	16	9
			24	192	38	60	94	17	123	44	55	24
			25	154	41	87	26	32	94	25	47	22

APPENDIX 3.5: EXPERIMENT IV: RAW DATA

Passage 'P'

Recall order	Version	Subject no.	W	V	X	I
		2	129	78	29	22
		4	81	42	29	10
		13	89	40	27	22
	Pe	19	122	68	31	23
		28	151	57	52	42
		36	115	54	45	16
		1	95	55	35	5
		12	45	15	26	4
1st	Pi	16	78	42	32	4
		22	29	7	17	5
		31	131	70	55	6
		34	92	37	43	12
		6	90	46	35	9
		9	79	32	36	21
	Pa	14	94	45	35	14
		24	117	53	51	13
		29	82	31	34	17
		33	85	47	31	7
		3	142	72	51	19
		7	110	67	35	8
		17	82	33	40	9
	Pe	18	127	65	44	18
		30	100	58	28	14
		32	145	68	64	13
		5	94	53	41	0
		11	115	59	40	16
2nd	Pi	15	134	79	41	14
		20	100	46	42	12
		27	103	52	42	9
		35	105	58	37	10
		8	85	45	29	11
		10	136	69	56	11
	Pa	21	78	43	34	1
		23	143	78	53	12
		25	126	94	30	2
		26	82	35	34	13

Passage 'Q'

Recall order	Version	Subject no.	W	V	X	I
		10	120	71	29	20
		11	95	44	29	22
		20	62	19	35	18
	Qe	23	116	70	32	14
		25	117	81	35	1
		27	19	71	41	7
		3	117	71	36	10
		8	102	51	28	23
1st	Qi	18	94	53	25	16
		21	82	52	22	8
		26	56	27	26	3
		30	94	39	39	16
		5	89	42	25	22
		7	110	66	32	12
	Qa	15	117	46	44	27
		17	62	33	20	9
		32	86	52	24	10
		35	92	42	35	15
		6	108	65	32	11
		12	80	45	23	12
		22	28	4	14	10
	Qe	24	130	81	36	13
		33	89	55	23	11
		34	113	57	35	21
		2	116	68	29	19
		9	108	62	32	14
2nd	Qi	13	85	58	22	5
		14	93	46	34	13
		29	133	72	35	26
		36	90	52	27	11
		1	68	35	19	14
		4	84	44	27	13
	Qa	16	78	37	32	9
		19	112	71	29	12
		28	132	71	34	27
		31	114	87	23	4

APPENDIX 3.6: EXPERIMENT V: PASSAGE F: CLAUSE OMISSIONS

By subject

Subject	Total	Subject	Total	Subject	Total
1	18	15	12	29	15
2	24	16	17	30	16
3	20	17	26	31	20
4	17	18	24	32	16
5	24	19	14	33	25
6	18	20	26	34	22
7	16	21	20	35	17
8	17	22	30	36	15
9	20	23	20	37	22
10	26	24	18	38	20
11	14	25	21	39	27
12	21	26	21	40	17
13	30	27	15	41	15
14	22	28	22		

By clause

Clause	Total	Clause	Total	Clause	Total
1	4	20	6	39	8
2	5	21	24	40	13
3	40	22	4	41	41
4	17	23	0	42	25
5	10	24	6	43	13
6	40	25	4	44	5
7	32	26	23	45	17
8	7	27	26	46	34
9	2	28	0	47	33
10	16	29	1	48	1
11	13	30	7	49	1
12	17	31	6	50	0
13	18	32	22	51	0
14	12	33	1	52	17
15	34	34	0	53	33
16	22	35	2	54	35
17	13	36	11	55	12
18	33	37	18		
19	20	38	28		

APPENDIX 4.1: EXPERIMENT I: MEANS

By subjects

Clause recall and word-score means

Subject	Clauses	W	V	X	I	N
1F	20.6	125.9	70.4	41.8	13.7	9
2F	25.3	168.7	99.7	54.5	14.3	9
3F	26.9	199.9	127.6	54.6	17.8	9
4M	25.1	161.2	78.1	63.0	20.1	9
5M	23.8	162.4	77.6	59.7	25.2	9
6M	25.1	192.0	108.9	59.9	23.2	9
7F	25.6	177.0	100.6	61.1	15.3	9
8M	21.7	157.0	86.1	57.6	13.3	9
9M	19.6	123.1	63.6	50.9	8.7	9
10F	22.2	143.3	82.2	50.2	10.9	9
11F	18.8	140.4	61.1	53.1	26.2	9
12M	18.9	119.2	56.7	46.8	15.8	9
13F	19.0	131.4	70.6	46.2	14.7	9
14M	26.3	166.3	100.7	52.6	13.1	9
15F	27.3	200.6	132.8	53.9	13.9	9
16M	23.7	171.9	90.4	59.9	21.6	9
17F	25.3	173.3	89.3	60.0	24.0	9
18M	27.4	194.0	130.6	53.4	10.0	9
all M	23.5	160.8	88.1	55.0	16.8	81
all F	23.5	162.2	92.7	53.0	16.8	81
all Ss	23.5	161.5	90.4	54.5	16.8	162
sd on Ss' means	3.1	26.3	23.2	5.8	5.4	18
overall sd	4.4	34.4	29.0	13.3	9.3	162

By passages

Clause recall and word-score means

Passage	Clauses	W	V	X	I	N
1A	25.3	168.8	96.9	52.5	19.4	18
1B	24.8	170.2	98.7	52.2	19.2	18
1C	21.8	156.2	84.1	55.7	16.4	18
2A	23.2	152.8	76.9	57.7	18.2	18
2B	24.9	173.8	91.1	66.7	16.1	18
2C	24.3	167.8	95.7	56.1	16.1	18
3A	21.9	148.8	97.8	42.0	9.1	18
3B	23.7	159.9	88.3	53.8	17.8	18
3C	21.3	155.5	83.9	52.3	18.7	18
ALL	23.5	16.5	90.4	54.5	16.8	162
sd on passage means)	1.5	8.8	7.3	6.4	3.2	9
overall sd)	4.3	34.4	29.0	13.3	9.3	162

By order of administration

Clause recall and word-score means

Session-trial	Clauses	W	V	X	I	N
1-1	20.7	138.8	68.9	51.7	19.4	18
1-2	23.9	164.2	90.4	56.1	17.8	18
1-3	22.9	157.8	91.2	52.1	14.5	18
2-1	22.9	154.1	83.2	53.8	17.2	18
2-2	24.0	168.1	93.6	56.9	17.5	18
2-3	23.7	166.1	95.4	55.0	15.7	18
3-1	23.7	164.8	93.3	54.3	17.2	18
3-2	25.4	173.9	100.2	57.3	15.9	18
3.3	24.1	166.3	97.2	53.5	15.7	18
ALL	23.5	161.5	90.4	54.5	16.8	162
sd on trial means)	1.3	10.3	9.3	2.0	1.5	9
overall sd)	4.4	34.4	29.0	13.3	9.3	162

APPENDIX 4.2: EXPERIMENT I: ANOVA SUMMARY TABLES

Clause recall

Source	df	SS	MS	F	p
Squares	1	55.710	55.710	<1	n.s.
Subjects *	16	1375.580	85.974		
BETWEEN SUBJECTS	17	1431.290	84.193	9.817	<<0.001
Passages	8	321.123	40.140	4.681	<0.001
Order	8	236.235	29.529	3.443	<0.01
Error	128	1097.753	8.576		
WITHIN SUBJECTS	144	1655.111			
TOTAL	161	3086.401			

Total words - W

Source	df	SS	MS	F	p
Squares	1	10496.4	10496.4	1.759	n.s.
Subjects *	16	95482.2	5967.8		
BETWEEN SUBJECTS	17	105980.6	6232.2	13.68	<<0.001
Passages	8	11215.4	1401.9	3.076	<0.01
Order	8	15136.8	1892.1	4.151	<0.001
Error	128	58341.4	455.8		
WITHIN SUBJECTS	144	84693.6			
TOTAL	161	190675.2			

Verbatim recall - V

Source	df	SS	MS	F	p
Squares	1	5396.4	5396.4	1.098	n.s.
Subjects *	16	78627.2	4914.2		
BETWEEN SUBJECTS	17	84023.6	4942.6	20.61	<<0.001
Passages	8	8365.3	1045.7	4.360	<0.001
Order	8	12629.8	1578.7	6.583	<0.001
Error	128	30698.3	239.8		
WITHIN SUBJECTS	144	51693.4			
TOTAL	161	135717.0			

* ie between subjects variance within squares

Nonverbatim recall - X

Source	df	SS	MS	F	p
Squares	1	160.0	160.0	<1	n.s.
Subjects *	16	5224.4	326.5		
BETWEEN SUBJECTS	17	5384.4	316.7	2.459	<0.01
Passages	8	5947.2	743.4	5.774	<0.001
Order	8	5947.2	743.4	5.774	<0.001
Error	128	16480.1	128.8		
WITHIN SUBJECTS	144	22992.0			
TOTAL	161	28376.4			

Intrusions - I

Source	df	SS	MS	F	p
Squares	1	320.89	320.89	1.249	n.s
Subjects *	16	4110.64	256.92		
BETWEEN SUBJECTS	17	4431.53	89.44	1.531	n.s.
Passages	8	1445.20	180.65	3.093	<0.01
Order	8	302.20	37.78	<1	n.s.
Error	128	7477.16	58.42		
WITHIN SUBJECTS	144	9224.56			
TOTAL	161	13656.09			

* ie between subjects variance within squares

APPENDIX 4.3: EXPERIMENT II: MEANS

By instructions, order and passages

Factor		W	V	X	I	N
		Word-score means				
Instructions	(P	129.5	70.3	47.5	11.7	36
	(N	136.5	71.2	52.3	13.3	36
	(L	156.6	73.3	62.4	20.5	36
Passage	(1A	140.3	73.3	52.4	14.1	36
	(2C	150.3	73.9	58.5	18.2	36
	(3B	131.9	67.7	51.3	13.2	36
Order	(1	120.9	54.1	51.2	16.1	36
	(2	144.3	75.1	55.4	14.6	36
	(3	157.2	85.7	55.6	14.8	36
Overall	(mean	140.8	71.6	54.1	15.2	108
	(sd	38.7	25.9	15.5	10.0	108

By instructions-order combinations

Order	Instructions	W	V	X	I
1	(P	116.2	57.1	46.3	13.8
	(N	109.8	50.9	46.8	12.8
	(L	136.4	54.2	60.6	21.7
2	(P	127.8	69.4	47.0	10.5
	(N	142.3	74.0	55.2	13.1
	(L	162.8	81.8	60.1	20.1
3	(P	144.2	84.3	49.2	10.8
	(N	157.4	88.7	54.9	13.8
	(L	170.6	83.3	66.7	19.8

APPENDIX 4.4: EXPERIMENT II: ANOVA SUMMARY TABLES FOR WORD-SCORE DATA

Total words - W

Source	df	SS	MS	F	p
Instructions	2	14284.4	7142.2	3.988	<0.05
Squares *	9	29412.6	3268.1	1.825	n.s.
Error	24	42987.4	1791.1		
BETWEEN SUBJECTS	35	86684.3			
Passages	2	6120.2	3060.1	4.566	<0.05
Order	2	24867.1	12433.5	18.55	<0.001
P x I	4	495.5	123.9	<1	n.s.
O x I	4	1895.3	473.8	<1	n.s.
Error	60	40208.7	670.2		
WITHIN SUBJECTS	72	73586.7			
TOTAL	107	160271.0			

Verbatim recall - V

Source	df	SS	MS	F	p
Instructions	2	146.7	73.4	<1	n.s.
Squares *	9	12617.4	1401.9	1.332	n.s.
Error	24	25252.2	1052.2		
BETWEEN SUBJECTS	35	38016.3			
Passages	2	774.2	387.1	1.809	n.s.
Order	2	18354.7	9177.3	42.89	<<0.001
P x I	4	750.1	187.5	<1	n.s.
O x I	4	1213.8	303.4	1.418	n.s.
Error	60	12837.9	214.0		
WITHIN SUBJECTS	72	33930.7			
TOTAL	107	71947.0			

* ie between subjects variance within squares

Nonverbatim recall - X

Source	df	SS	MS	F	p
Instructions	2	4203.9	2102.0	13.57	<0.001
Squares *	9	1070.2	118.9	<1	n.s.
Error	24	3718.7	154.9		
BETWEEN SUBJECTS	35	8992.7			
Passages	2	1082.3	541.2	2.267	n.s.
Order	2	583.7	291.8	1.223	n.s.
P x I	4	544.0	136.0	<1	n.s.
O x I	4	333.1	83.3	<1	n.s.
Error	60	14321.5	238.7		
WITHIN SUBJECTS	72	16864.7			
TOTAL	107	25857.4			

Intrusions - I

Source	df	SS	MS	F	p
Instructions	2	1600.96	800.48	5.478	<0.01
Squares *	9	1640.47	182.28	1.247	n.s.
Error	24	3506.89	146.12		
BETWEEN SUBJECTS	35	6748.32			
Passages	2	506.02	253.01	4.882	<0.05
Order	2	50.24	25.12	<1	n.s.
P x I	4	229.76	57.44	1.108	n.s.
O x I	4	62.70	15.68	<1	n.s.
Error	60	3109.27	51.82		
WITHIN SUBJECTS	72	3958.00			
TOTAL	107	10706.32			

* ie between subjects variance within squares

APPENDIX 4.5: EXPERIMENT III: MEANS

Session 1, both passages

Factor		W	V	X	I		N
		Word-score means					
Passage S	(read first	140.1	61.0	54.4	24.6	)	
	(read second	140.0	71.0	45.8	23.5	)	8
Passage T	(read first	195.5	93.0	71.9	30.6	)	
	(read second	176.4	86.9	67.3	22.3	)	
	Read first	167.8	77.0	63.2	27.6	)	16
	Read second	158.2	78.9	56.5	22.9	)	
Passage S	(mean	140.1	66.0	50.1	24.1	)	
	(s.d.	28.4	21.8	10.5	9.5	)	16
Passage T	(mean	185.9	90.0	69.6	26.4	)	
	(s.d.	22.2	18.0	10.5	12.0	)	
Overall	(mean	163.0	78.0	59.8	25.3	)	32
	(s.d	34.2	23.1	14.2	10.5	)	

Session 2, Passage S

Factor	W	V	X	I		N
	Word-score means					
Read first	124.3	41.8	52.2	30.2	)	16
Read second	149.7	44.3	61.2	44.2	)	
Recalled before	138.4	53.0	54.5	30.9	)	16
Not recalled before	135.6	33.1	59.0	43.6	)	
Recalled first	123.7	38.0	52.1	33.6	)	16
Recalled second	150.3	48.0	61.4	40.9	)	
Overall (mean	137.0	43.0	56.8	37.2	)	32
(s.d.	36.0	18.3	13.8	24.2	)	

Session 2, Passage T

Factor	W	V	X	I		N
	Word-score means					
Read first	139.8	54.6	56.4	28.7	)	16
Read second	141.4	52.5	57.9	31.0	)	
Recalled before	173.2	73.8	71.0	28.4	)	16
Not recalled before	108.0	33.4	43.4	31.3	)	
Recalled first	163.1	61.3	62.9	38.9	)	16
Recalled second	118.1	45.8	51.4	20.8	)	
Overall (mean	140.6	53.6	57.2	29.8	)	32
(s.d.	52.0	26.7	19.5	17.7	)	

APPENDIX 4.6: EXPERIMENT III: ANOVA SUMMARY TABLES

Session 1, both passages

Score	Source	df	SS	MS	F	p
(	Passage	1	16836	16836	25.90	<<0.001
(	Reading	1	741	741	1.15	n.s.
W (	P x R	1	722	722	1.12	n.s.
(	Error	28	18063	645		
(	TOTAL	31	36362			
(	Passage	1	4584	4584	11.24	<0.01
(	Reading	1	30	30	<1	n.s.
V (	P x R	1	520	520	1.27	n.s.
(	Error	28	11431	408		
(	TOTAL	31	16565			
(	Passage	1	3022.5	3022.5	30.13	<<0.001
(	Reading	1	357.8	357.8	3.57	n.s.
X (	P x R	1	34.0	34.0	<1	n.s.
(	Error	28	2809.9	100.3		
(	TOTAL	31	6224.2			
(	Passage	1	45.1	45.1	<1	n.s.
(	Reading	1	180.5	180.5	1.64	n.s.
I (	P x R	1	105.1	105.1	<1	n.s.
(	Error	28	3077.2	109.9		
(	TOTAL	31	3408.0			

Session 2, Passage S

Score	Source	df	SS	MS	F	p
	(Reading	1	5151	5151	5.04	<0.05
	(Before	1	61	61	<1	n.s.
	(Order	1	5670	5670	5.53	<0.05
	(R x B	1	3570	3570	3.40	n.s.
W	(R x O	1	8	8	<1	n.s.
	(B x O	1	136	136	<1	n.s.
	(R x B x O	1	339	339	<1	n.s.
	(Error	24	25239	1052		
	(TOTAL	31	40174			
	(Reading	1	48	48	<1	n.s.
	(Before	1	3180	3180	14.72	<0.001
	(Order	1	810	810	3.75	n.s.
	(R x B	1	358	358	1.66	n.s.
V	(R x O	1	23	23	<1	n.s.
	(B x O	1	587	587	2.72	n.s.
	(R x B x O	1	157	157	<1	n.s.
	(Error	24	5183	216		
	(TOTAL	31	10345			
	(Reading	1	675.3	675.3	5.05	<0.05
	(Before	1	175.8	175.8	1.31	n.s.
	(Order	1	657.0	657.0	4.91	<0.05
	(R x B	1	140.3	140.3	1.05	n.s.
X	(R x O	1	11.3	11.3	<1	n.s.
	(B x O	1	7.0	7.0	<1	n.s.
	(R x B x O	1	0.9	0.9	<1	n.s.
	(Error	24	3210.3	13.8		
	(TOTAL	31	4877.8			
	(Reading	1	1544	1544	3.05	n.s.
	(Before	1	1288	1288	2.52	n.s.
	(Order	1	428	428	<1	n.s.
	(R x B	1	872	872	1.71	n.s.
I	(R x O	1	23	23	<1	n.s.
	(B x O	1	109	109	<1	n.s.
	(R x B x O	1	20	20	<1	n.s.
	(Error	24	12243	510		
	(TOTAL	31	16535			

Session 2, Passage T

W	Reading	1	23	23	<1	n.s.
	Before	1	33996	33996	32.19	<<0.001
	Order	1	16245	16245	15.38	<0.001
	R x B	1	4536	4536	4.30	<0.05
	R x O	1	2610	2610	2.47	n.s.
	B x O	1	95	95	<1	n.s.
	R x B x O	1	871	871	<1	n.s.
	Error	24	25460	1056		
	TOTAL	31	83836			
V	Reading	1	36	36	<1	n.s.
	Before	1	13041	13041	47.89	<<0.001
	Order	1	1922	1922	7.07	<0.05
	R x B	1	465	465	1.71	n.s.
	R x O	1	25	25	<1	n.s.
	B x O	1	41	41	<1	n.s.
	R x B x O	1	24	24	<1	n.s.
	Error	24	6536	272		
	TOTAL	31	22090			
X	Reading	1	18.0	18.0	<1	n.s.
	Before	1	6105.2	6105.2	31.93	<<0.001
	Order	1	1058.0	1058.0	5.53	<0.05
	R x B	1	450.0	450.0	2.35	n.s.
	R x O	1	990.1	990.1	5.18	<0.05
	B x O	1	144.5	144.5	<1	n.s.
	R x B x O	1	0.1	0.1	<1	n.s.
	Error	24	4589.0	191.2		
	TOTAL	31	13354.9			
I	Reading	1	43	43	<1	n.s.
	Before	1	63	63	<1	n.s.
	Order	1	2610	2610	7.21	<0.05
	R x B	1	604	604	1.67	n.s.
	R x O	1	215	215	<1	n.s.
	B x O	1	75	75	<1	n.s.
	R x B x O	1	621	621	1.72	n.s.
	Error	24	8693	363		
	TOTAL	31	13424			

APPENDIX 4.7: EXPERIMENT III: ANALYSIS OF GROUP DIFFERENCES

Explanation

The purpose of this small study is to compare the two main groups of subjects in Experiment III to determine how its results might have been due to inadvertent group differences. The two groups of subjects were those recalling Passage S in the first session ('Group S'), and those recalling Passage T in the first session ('Group T').

Previous data from Experiments I or II was used to estimate each subject's performance *in relation to other subjects*. This is shown in the second Table below, where each subject's word-score means are expressed as a difference between from the mean for the condition. Positive values indicate higher scores than the condition mean. Group T subjects do appear to have scored higher on these measures in the past, but the differences are small and the *numbers* of subjects scoring above or below their earlier means are roughly equal for each group. Group differences are not significant on t-tests, except marginally for intrusions. The first table summarises data from Experiment III alongside the same figures 'corrected' to account for the group differences that *were* found. Unsurprisingly, these corrections have little effect on the results, which seem to be the product of genuine differences between the passages themselves.

Word-score data before and after 'correction' for group differences

Passage / Session		Word-score means W	V	X	I	Group	N
Original data							
S	1	140.1	66.0	50.1	24.1	S	16
	2R	138.4	53.0	54.5	30.9	S	
	2N	135.6	33.1	59.0	43.6	T	
T	1	185.9	90.0	69.6	26.4	T	16
	2R	173.2	73.8	71.0	28.4	T	
	2S	108.0	33.4	43.4	31.3	S	
S & T	1	163.0	78.0	59.9	25.3	S&T	32
	2R	155.8	63.4	62.8	29.7	S&T	
	2N	121.8	33.3	51.2	37.5	S&T	
'Corrected' data							
S	1	143.5	65.0	51.6	27.0	S	16
	2R	141.8	52.0	56.0	33.8	S	
	2N	129.7	28.9	57.5	43.0	T	
T	1	179.6	85.8	68.1	25.8	T	16
	2R	166.9	69.6	69.5	27.8	T	
	2N	111.4	32.4	44.9	34.2	S	
S & T	1	161.6	75.4	59.9	26.4	S&T	32
	2R	154.4	60.8	62.8	30.8	S&T	
	2N	120.6	30.7	51.2	38.6	S&T	

Recall performance of all subjects in previous experiments expressed as deviations from the mean of their experimental conditions

Group	Subject number	Previous experiment & condition	W	V	X	I
			Mean word-score deviations			
(	1	II P	+16.5	+18.7	+2.5	-4.7
(	2	II P	-7.9	-9.0	+1.5	-0.5
(	3	II N	+14.2	+4.5	+9.4	0.0
(	4	II L	+10.1	+23.0	-3.1	-9.5
(	13	II P	+3.2	+3.0	+3.5	-3.4
(	14	II N	-1.5	-7.9	+0.4	+5.7
(	15	II L	+0.7	+14.0	-3.7	-9.8
S (	16	I	+4.7	+10.4	-2.1	-3.7
(	17	II L	-15.1	+1.0	-9.1	-6.8
(	18	I	+15.5	+10.2	+6.7	-1.5
(	19	II N	-62.4	-32.2	-22.3	-8.0
(	20	II N	-6.9	-11.9	+4.0	+0.7
(	29	I	+39.1	+41.8	0.0	-2.9
(	30	II N	-24.8	-10.2	-7.0	-7.3
(	31	II L	-17.7	-18.6	-5.7	+6.8
(	32	II P	-21.5	-21.3	+0.5	-0.7
(	5	I	-18.2	-8.9	-3.4	-5.9
(	6	II P	+17.8	+5.0	+13.2	-0.4
(	7	II P	-5.5	-17.0	+6.2	+5.3
(	8	I	+38.4	+37.1	+0.3	+1.0
(	9	II P	+36.5	+47.7	-4.8	-6.7
(	10	II L	+50.9	+24.4	+17.6	+9.2
(	11	II N	+50.2	+47.1	+4.0	-1.3
T (	12	II N	+5.2	-6.5	+5.0	+6.4
(	21	II N	-11.8	+0.5	-6.6	-6.0
(	22	II L	-19.9	-5.0	-7.4	-7.2
(	23	II P	-9.5	-3.3	-5.8	-0.4
(	24	II L	-8.4	-21.6	+5.9	+7.5
(	25	II N	+46.0	+15.1	+19.7	+11.0
(	26	II L	+1.7	+3.0	+3.3	-4.2
(	27	II N	-17.2	-10.9	-6.6	0.0
(	28	II P	-55.8	-40.3	-17.2	+1.6
	Group S	(mean	-3.4	+1.0	-1.5	-2.9
		(s.d.	23.3	29.8	7.4	4.9
	Group T	(mean	+6.3	+4.2	+1.5	+0.6
		(s.d.	30.8	24.6	10.3	5.9
1-tailed t-test		(t	1.005	0.321	0.916	1.768
		(p	n.s.	n.s.	n.s.	<0.05

APPENDIX 4.8: RATING STUDY: MEAN RATINGS OF CLAUSES

Passage and clause type		N*	A	B	C	D	E	F	G	H	I
1A	peripheral	7	3.79	4.39	3.57	3.36	4.50	2.82	3.86	3.61	5.18
	redundant	9	4.25	4.81	4.06	3.72	4.83	3.17	3.56	3.86	5.20
	remainder	15	4.20	5.22	3.98	3.62	5.07	3.73	2.63	3.73	5.53
	most omitted	9	4.00	4.45	4.08	3.75	4.42	3.08	3.53	3.78	4.86
	least omitted	21	4.18	5.23	3.95	3.54	5.07	3.46	2.90	3.65	5.52
	overall	30	4.13	4.99	4.00	3.60	4.88	3.35	3.09	3.69	5.32
2C	peripheral	7	4.00	6.07	3.79	3.39	4.11	4.25	3.47	3.39	4.61
	redundant	11	4.04	5.32	4.00	3.09	3.89	3.84	3.86	3.80	4.84
	remainder	15	3.63	5.40	4.32	3.45	4.25	4.35	3.75	3.85	4.73
	most omitted	8	3.81	5.41	3.66	3.19	4.06	3.97	3.88	3.85	4.81
	least omitted	22	3.91	5.47	4.17	3.46	4.32	4.28	3.76	3.81	4.81
	overall	30	3.88	5.45	4.03	3.38	4.25	4.20	3.78	3.82	4.81
3B	peripheral	10	3.78	4.85	4.13	3.63	4.68	5.65	3.93	4.60	4.98
	redundant	8	3.66	4.97	3.41	4.16	4.69	4.82	4.47	4.78	5.13
	remainder	14	4.09	5.54	4.77	3.96	4.43	5.08	3.60	3.77	4.55
	most omitted	10	3.83	4.78	3.88	3.55	4.38	5.08	4.25	4.53	5.10
	least omitted	20	3.94	5.50	4.54	4.06	4.61	5.43	3.39	4.05	4.66
	overall	30	3.90	5.26	4.32	3.89	4.53	5.31	3.82	4.21	4.81
All	peripheral	24	3.86	5.10	3.83	3.46	4.43	4.24	3.75	3.87	4.92
	redundant	28	3.98	4.97	3.82	3.66	4.47	3.94	3.96	4.15	5.17
	remainder	44	3.97	5.39	4.36	3.68	4.58	4.39	3.33	3.77	4.94
	most omitted	27	3.88	4.88	3.87	3.50	4.28	4.04	3.89	4.05	4.92
	least omitted	63	3.99	5.40	4.22	3.69	4.67	4.39	3.35	3.84	5.00
	overall	90	3.97	5.20	4.12	3.62	4.55	4.29	3.56	3.91	4.97

* a total of 6 clauses were classified as *both* peripheral and redundant

APPENDIX 4.9: EXPERIMENT IV: MEANS

Passage P

Clause recall and word-score means

Condition/Passage		Clauses	W	V	X	I	N
recalled first	(Pe	16.5	114.5	56.5	35.5	22.5	)
	(Pi	12.8	78.3	37.7	34.7	6.0	)
	(Pa	13.5	91.2	42.3	37.0	13.5	)
							) 6
recalled second	(Pe	16.2	117.7	60.5	43.7	13.5	)
	(Pi	16.2	108.5	57.8	40.5	10.2	)
	(Pa	16.0	108.3	60.7	39.3	8.3	)
first & second	(Pe	16.3	116.1	58.5	39.6	18.0	)
	(Pi	14.5	93.5	47.8	37.6	8.1	) 12
	(Pa	14.8	99.8	51.5	38.2	10.9	)
recalled first		14.3	94.7	45.5	35.7	14.0	) 18
recalled second		16.1	111.5	59.7	41.2	10.7	)
overall	(mean	15.2	103.1	52.6	38.4	12.3	) 36
	(s.d.	3.2	27.2	18.0	9.9	7.7	)

Passage Q

Clause recall and word-score means

Condition/Passage		Clauses	W	V	X	I	N
recalled first	(Qe	15.2	104.8	59.3	31.8	13.7	)
	(Qi	14.7	90.8	48.8	29.3	12.7	)
	(Qa	15.3	92.7	46.8	29.3	12.7	)
							) 6
recalled second	(Qe	15.2	91.3	51.2	27.2	13.0	)
	(Qi	16.2	104.2	59.7	29.8	14.7	)
	(Qa	13.3	98.0	57.5	27.3	13.2	)
first & second	(Qe	15.2	98.1	55.3	29.5	13.3	)
	(Qi	15.4	97.5	54.3	29.6	13.7	) 12
	(Qa	14.3	95.3	52.2	28.7	14.5	)
recalled first		15.1	96.1	51.7	30.4	14.1	) 18
recalled second		14.9	97.8	56.1	28.1	13.6	)
overall	(mean	15.0	97.0	53.9	29.3	13.8	) 36
	(s.d.	3.6	23.0	18.0	6.5	6.2	)

APPENDIX 4.10: EXPERIMENT III: ANOVA SUMMARY TABLES
FOR CLAUSE RECALL AND WORD-SCORE DATA

Passage P

Variable	Source	df	SS	MS	F	p
(	Version	2	23.72	11.86	1.21	n.s.
(	Order	1	30.25	30.25	3.09	n.s.
Clauses (	V x O	2	22.17	11.09	1.13	n.s.
(	Error	30	293.50	9.78		
(	TOTAL	35	369.64			
(	Version	2	3283	1641	2.51	n.s.
(	Order	1	2550	2550	3.90	n.s.
W (	V x O	2	1094	547	<1	n.s.
(	Error	30	19626	654		
(	TOTAL	35	26553			
(	Version	2	714	358	1.24	n.s.
(	Order	1	1806	1806	6.26	<0.05
V (	V x O	2	470	235	<1	n.s.
(	Error	30	8652	288		
(	TOTAL	35	11643			
(	Version	2	25.4	12.7	<1	n.s.
(	Order	1	266.8	266.8	2.50	n.s.
X (	V x O	2	51.7	25.9	<1	n.s.
(	Error	30	3201.0	106.7		
(	TOTAL	35	3544.9			
(	Version	2	626.2	313.1	8.11	<0.01
(	Order	1	100.0	100.0	2.59	n.s.
I (	V x O	2	257.1	137.6	3.56	<0.05
(	Error	30	1158.7	38.6		
(	TOTAL	35	2160.0			

Passage Q

Variable	Source	df	SS	MS	F	p
(	Version	2	7.72	3.86	<1	n.s.
(	Order	1	0.25	0.25	<1	n.s.
Clauses (	V x O	2	18.50	9.25	<1	n.s.
(	Error	30	444.50	14.82		
(	TOTAL	35	470.97			
(	Version	2	50	25	<1	n.s.
(	Order	1	27	27	<1	n.s.
W (	V x O	2	1139	570	<1	n.s.
(	Error	30	17777	593		
(	TOTAL	35	18993			
(	Version	2	57	29	<1	n.s.
(	Order	1	6	6	<1	n.s.
V (	V x O	2	538	269	<1	n.s.
(	Error	30	11011	367		
(	TOTAL	35	11612			
(	Version	2	39.5	19.8	<1	n.s.
(	Order	1	80.0	80.0	1.70	n.s.
X (	V x O	2	7.6	3.8	<1	n.s.
(	Error	30	1413.2	47.1		
(	TOTAL	35	1540.1			
(	Version	2	8.7	4.3	<1	n.s.
(	Order	1	1.8	1.8	<1	n.s.
I (	V x O	2	32.8	16.4	<1	n.s.
(	Error	30	1307.7	43.6		
(	TOTAL	35	1351.0			

APPENDIX 5.1: EXPERIMENT I: CLAUSE OMISSION FREQUENCIES

Clause no.	Omissions per clause, by passage									Mean omissions per clause by structure			
	1A	1B	1C	2A	2B	2C	3A	3B	3C	1	2	3	ALL
1	0	0	0	0	0	0	0	1	0	0.0	0.0	0.3	0.1
2	0	0	0	0	4	4	0	2	0	0.0	2.7	0.7	1.1
3	0	1	0	0	1	5	1	5	1	0.3	2.0	2.3	1.5
4	3	3	2	3	2	11	0	1	3	2.7	5.3	1.3	3.1
5	2	0	6	5	0	0	2	0	1	2.7	1.7	1.0	1.8
6	0	0	0	3	2	7	3	3	1	0.0	4.0	2.3	2.1
7	0	1	3	4	2	10	2	10	2	1.3	5.3	4.7	3.8
8	1	0	4	9	3	2	5	6	1	1.7	4.7	4.0	3.4
9	2	2	6	1	6	11	0	0	7	3.3	6.0	2.3	3.9
10	7	2	8	1	1	0	5	2	8	5.7	0.7	5.0	3.8
11	0	3	16	0	4	1	7	4	7	6.3	1.7	6.0	4.7
12	5	6	3	3	0	0	9	4	8	4.7	1.0	7.0	4.2
13	5	1	7	4	5	0	10	10	9	4.3	3.0	9.7	5.7
14	10	0	4	11	6	0	6	2	10	4.7	5.7	6.0	5.4
15	2	7	10	11	3	14	7	3	4	6.3	9.3	4.7	6.8
16	5	7	5	4	5	0	8	3	7	5.7	3.0	6.0	4.9
17	12	0	3	5	3	0	6	5	8	5.0	2.7	6.3	4.7
18	2	3	7	10	2	3	2	4	1	4.0	5.0	2.3	3.8
19	0	9	6	7	1	4	4	7	2	5.0	4.0	4.3	4.4
20	5	6	4	12	2	5	6	8	8	5.0	6.3	7.3	6.2
21	4	0	8	0	6	6	4	1	8	4.0	4.0	4.3	4.1
22	1	0	10	2	5	0	4	4	14	3.7	2.3	7.3	4.4
23	0	12	10	5	8	2	5	2	2	7.3	5.0	3.0	5.1
24	9	5	11	5	6	3	11	2	1	8.3	4.7	4.7	5.9
25	0	0	3	8	1	0	8	9	9	1.0	3.0	8.7	4.2
26	0	2	5	1	3	5	5	2	8	2.3	3.0	5.0	3.4
27	2	11	4	3	1	0	5	1	7	5.7	1.3	4.3	3.8
28	1	2	3	4	0	6	7	7	8	2.0	3.3	7.3	3.8
29	2	12	0	1	4	1	11	4	10	4.7	2.0	8.3	5.0
30	1	1	0	2	5	2	2	0	2	0.7	3.0	1.3	1.7
mean	2.7	3.2	4.9	4.1	3.0	3.4	4.8	3.7	5.2	3.6	3.5	4.6	3.90
s.d.	3.2	3.8	3.9	3.6	2.2	3.9	3.2	3.1	3.8	2.0	1.9	2.4	1.52

APPENDIX 5.2: EXPERIMENT I: CLAUSE OMISSION FREQUENCIES: OBSERVED AND EXPECTED DISTRIBUTIONS

Pass.	Distr.	Omission frequency (out of 18)																
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1A	Obs.	10	4	6	1	1	4	0	1	0	1	1	0	1				
	Exp.	1.6	5.1	7.7	7.2	4.8	2.4	0.9	0.3	0.1								
1B	Obs.	10	4	4	3	0	1	2	2	0	1	0	1	2				
	Exp.	0.9	3.4	6.3	7.3	5.9	3.6	1.7	0.6	0.2	0.1							
1C	Obs.	6	0	1	5	4	2	3	2	2	0	3	1	0	0	0	0	1
	Exp.	0.1	0.6	2.1	4.1	5.9	6.2	5.2	3.3	1.7	0.7	0.2	0.1					
2A	Obs.	5	4	2	4	4	4	0	1	1	1	1	2	1				
	Exp.	0.3	1.5	3.7	5.9	6.6	5.5	3.6	1.8	0.7	0.3	0.1						
2B	Obs.	4	5	5	4	3	4	4	1									
	Exp.	1.1	4.0	6.8	7.4	5.6	3.2	1.4	0.5	0.1								
2C	Obs.	11	2	3	2	2	3	2	1	0	0	1	2	0	0	1		
	Exp.	0.7	2.9	5.8	7.1	6.2	4.1	2.1	0.8	0.3	0.1							
3A	Obs.	4	1	4	1	3	5	3	3	2	1	1	2					
	Exp.	0.1	0.7	2.2	4.4	6.0	6.2	4.9	3.1	1.6	0.6	0.2	0.1					
3B	Obs.	3	4	6	3	5	2	1	2	1	1	2						
	Exp.	0.5	2.2	4.8	6.7	6.6	4.8	2.7	1.2	0.4	0.1							
3C	Obs.	2	6	4	1	1	0	0	4	7	2	2	0	0	0	1		
	Exp.	0.1	0.5	1.6	3.5	5.4	6.1	5.5	3.8	2.2	1.0	0.4	0.1					
ALL	Obs	55	30	35	24	23	25	15	17	13	7	11	8	4	0	2	1	
	Exp.	5	21	41	54	53	42	28	15	7	3	1						

APPENDIX 5.3: EXPERIMENTS I AND II: PASSAGES 1A, 2C, 3B:
CLAUSE OMISSIONS BY CONDITION

I = Experiment I
P, N, L = 'Precise', 'Normal', 'Liberal' conditions, Experiment II

Cl.	----Passage 1A----					----Passage 2C----					----Passage 3B----				
No.	I	P	N	L	all	I	P	N	L	all	I	P	N	L	all
1	0	0	1	0	1	0	0	0	0	0	1	1	0	0	2
2	0	2	0	1	3	4	3	1	2	10	2	6	5	1	14
3	0	2	1	1	4	5	7	5	5	22	5	4	6	1	16
4	3	2	3	1	9	11	7	7	3	28	1	1	1	0	3
5	2	3	4	1	10	0	0	0	1	1	0	0	3	1	4
6	0	0	3	0	3	7	8	5	6	26	3	4	1	4	12
7	0	1	1	0	2	10	10	7	9	36	10	10	10	8	38
8	1	1	3	0	5	2	0	3	0	5	6	8	8	7	29
9	2	5	6	2	15	11	9	6	7	33	0	3	3	2	8
0	7	8	4	6	25	0	1	0	0	1	2	4	2	0	8
1	0	0	1	3	4	1	4	2	2	9	4	5	3	3	15
2	5	7	5	6	23	0	0	0	0	0	4	5	5	6	20
3	5	6	7	4	22	0	2	1	0	3	10	6	9	2	27
4	10	8	6	3	27	0	6	3	1	10	2	3	4	0	9
5	2	8	6	6	22	14	10	8	5	37	3	2	1	0	6
6	5	6	8	6	25	0	0	0	0	0	3	5	2	2	12
7	12	10	10	11	43	0	0	0	0	0	5	6	5	5	21
8	2	2	3	1	8	3	3	1	1	8	4	5	5	4	18
9	0	2	0	0	2	4	6	2	3	15	7	6	5	8	26
0	5	8	4	7	24	5	6	6	6	23	8	8	5	8	29
1	4	2	3	3	12	6	4	5	4	19	1	1	2	1	5
2	1	4	1	0	6	0	0	1	0	1	4	4	5	4	17
3	0	1	0	1	2	2	1	3	0	6	2	1	7	4	14
4	9	8	7	8	32	3	0	2	2	7	2	5	6	5	18
5	0	1	2	1	4	0	1	3	2	6	9	10	8	6	33
6	0	1	0	0	1	5	8	8	8	29	2	3	4	5	14
7	2	1	1	1	5	0	0	1	1	2	1	5	4	4	14
8	1	0	0	1	2	6	4	4	5	19	7	11	9	9	36
9	2	0	3	2	7	1	1	0	1	3	4	9	6	7	26
0	1	0	1	2	4	2	1	1	1	5	0	0	1	0	1

APPENDIX 5.4: EXPERIMENTS I AND II: PASSAGES 1A, 2C AND 3B: 'HALF-PASSAGES' OF THE 50% MOST AND 50% LEAST FREQUENTLY OMITTED CLAUSES

Passage 1A: least frequently omitted clauses

One day Ernu decided to hunt the giant armadillo. He went to his grandfather first and borrowed some of his poison arrows, ... After this he walked deep into the forest, where he slept the night on some dry leaves in a cave. Early in the morning he was wakened by a noise ... but eventually noticed a humped shape some way off ... quickly he fired several arrows into it ... and found the fabulous armadillo, but it was already quite dead ... to skin the monster of its tough, legendary hide. Then he had to drag the bulk back through the forest, and after many hours reached his tribe's village. He showed the hide to his grandfather, ... that he gave Ernu a fine timber hut.

Passage 1A: most frequently omitted clauses

... then visited the village shrine and prayed to his tribe's ancestral spirits ... and crept out of the cave into the moonlight. At first he could see nothing except the misty river-banks, ... Suddenly the shape vanished into the forest. Ernu ran after it. He plunged into the undergrowth, bow and arrows in hand. He followed the animal's tracks for over half an hour, until he came out into a swampy clearing. He looked around for a while before espying a shadowy depression in the undergrowth: ... There was a loud roar. He ran over ... Ernu jumped among the bushes ... who was so proud ...

Passage 2C: least frequently omitted clauses

In trying to shave one morning, ... that the motor made a most distubing grating sound ... I took the back of the razor off ... when a dozen tiny curlicues of metal fell out ... I then showed the razor to a friend, who knew a lot about such matters, ... and then he took the back off, whereupon some pieces of charred plastic rattled to the floor ... . He gave me a few words of advice: I should have found out long ago how to use an electric razor, and how to manage without the soap and razor blades ... I walked home disheartened ... getting out an old cut-throat with my left hand and with my right, tossing the battery razor through the window.

Passage 2C: most frequently omitted clauses

... which is always a dismal prospect before breakfast, I found to my surprise, on switching on, ... which alarmed me at first. Indeed I had never heard its like before ... to look inside for anything amiss, ... and disappeared into the carpet ... or so he let others believe. He said he didn't like the look of the steel fragments, ... alarming me even more, because there couldn't have been much left inside by then. But my friend placed the razor on the table, where the sunlight glistened on the rust ... which had had such a deleterious effect ... and went home to have a shave in the bathroom, ...

Passage 3B: least frequently omitted clauses

It was indeed a beautiful house. The decorators had tried their best with the decor; ... one saw classical, Georgian and ultramodern rooms immediately adjacent. The plumbers had installed a solid silver bath and conected it to unbelievably quiet water-piping, ... Glittering crystal taps projected from the foot of the bath. The kitchen had been uniquely fitted out: ... to enhance the walls by fusing their surfaces with oxyacetylene torches so that they acquired a glass-like finish, ... The architects had chosen the site of the house, ... so that it netled in its landscaping ... The nurserymen had been hired from a botanical gardens, and they planted many exotic shrubs, ... Both bride and groom were overjoyed with their new home.

Passage 3B: most frequently omitted clauses

... each room represented a different period: ... hidden from sight, which was to win an important industrial award ... one wall housed a deep-freeze the size of a small room, and the floor was supposedly self-cleaning. The builders had taken trouble ... and by using blue-tinted concrete. Heating was provided by large ceiling panels which were no fire hazard due to their low temperature ... and had positioned it carefully in relation to the terrain, ... as a chick snuggles in a hen's nest. The site also provided the maximum protection from the elements ... distributing them in clusters so as to lend an almost subtropical air to the setting ...

PPENDIX 5.5: EXPERIMENTS I AND II: RECALL CONTINGENCIES

ssage 1A: recall (1) and omission (0) of clauses

	Clauses																													
bjects	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	1	1	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1
5	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	1	0	1	1	0	0	0	1	0	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1
9	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	1	0	0	1	1	1	1	1	0	1	1	1
10	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	1	0	1	1	1	0	1	1	1	1	0	1
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	0	1	1	0	1	0	0	0	0	1	1	0	0	1	1	0	1	1	0	1	1	1
14	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
16	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17	1	1	1	0	1	1	1	1	1	0	1	0	0	0	1	0	1	1	1	1	1	1	1	0	1	1	1	0	0	0
18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
19	1	1	1	1	1	1	1	1	0	0	1	1	0	0	0	0	0	1	1	0	1	1	1	0	1	1	1	1	1	1
20	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	1	0	1	1	1	0	1	1	1	1	1	1
21	1	1	1	1	0	1	1	1	1	1	1	0	1	1	0	1	0	1	1	0	1	0	1	0	1	1	1	1	1	1
22	1	1	1	1	1	1	0	1	0	0	1	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1
23	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	1	0	1	0	0	1	1	1	0	1	1	1	1	1	1
24	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1
25	1	1	0	0	1	1	1	1	0	0	1	0	0	1	0	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1
26	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1
27	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	0	0	1	1	0	1	1	1	1	1	1
28	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
29	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1
30	1	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
31	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
32	1	1	1	1	1	0	1	1	0	1	1	0	0	0	1	0	0	1	1	1	1	1	1	0	0	1	1	1	1	1
33	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
34	0	1	0	1	0	0	1	1	1	0	1	0	0	1	0	0	0	0	1	0	0	1	1	1	1	1	1	1	0	1
35	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	0	1	1	1	1	0	1
36	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0	1	1	1	1	1	1
37	1	1	1	1	0	1	1	0	0	0	0	0	0	0	1	0	0	1	1	0	1	1	1	0	0	1	1	1	1	1
38	1	1	1	0	1	0	1	1	0	1	1	0	0	1	0	0	0	1	1	1	0	1	1	1	1	1	0	1	1	0
39	1	1	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	0	1
40	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1
41	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0	0	0	1	1	1	0	1	1	0	1	1	1	1	1	1
42	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	0	1	1	0	1	0	1	0	1	1	1	1	1	1
43	1	0	0	0	1	1	1	1	1	0	1	1	1	0	0	0	0	1	1	1	0	1	1	0	1	1	1	1	1	1
44	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
45	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	1	0	0	1	1	1	1	1	1	0	0	0
46	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1
47	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1	0	1	1	0	1	1	1	0	1	1	1	1	1	1
48	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	0	1	1	1	0	1	1	1	1	1	1
49	1	1	1	1	0	1	1	1	1	0	0	0	1	1	0	0	0	1	1	0	1	1	1	0	0	1	1	1	1	0
50	1	1	1	1	1	1	1	1	1	0	0	1	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
51	1	1	1	1	1	1	1	1	0	0	1	0	1	1	0	1	0	0	1	0	0	1	1	0	1	1	0	1	0	1
52	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1
53	1	1	1	1	1	1	1	1	0	1	0	0	0	1	1	0	0	1	1	1	1	1	1	0	1	1	1	1	1	1
54	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	0	1	1	0	1	1	1	0	1	1	1	1	1	1

assage 1A: contingency coefficients on recall of pairs of clauses

1														
.6E-1	2													
.7E-1	2.9E-1	3												
.2E-1	2.1E-1	4.8E-1	4											
.3E-1	1.3E-2	1.0E-1	1.6E-1	5										
.2E-1	8.5E-2	1.2E-2	3.2E-2	1.8E-2	6									
.2E-1	1.6E-1	8.6E-2	4.4E-2	5.6E-2	1.3E-1	7								
.9E-1	6.2E-2	1.9E-1	1.1E-1	1.4E-1	3.2E-2	1.1E-1	8							
.5E-2	5.1E-2	1.3E-1	2.4E-1	5.1E-2	7.4E-2	2.1E-1	3.1E-1	9						
.0E-2	1.8E-2	2.0E-1	1.3E-1	1.8E-1	5.0E-2	1.1E-1	1.5E-1	1.6E-3	10					
.2E-1	8.5E-2	1.2E-2	3.2E-2	1.8E-1	5.5E-2	1.3E-1	3.2E-2	7.4E-2	9.2E-2	11				
.1E-2	3.6E-2	6.6E-3	3.3E-2	1.1E-1	1.1E-1	7.0E-2	4.8E-2	2.1E-1	1.1E-2	1.1E-1	12			
.6E-2	4.6E-2	1.3E-1	1.8E-1	2.6E-2	1.2E-1	1.4E-1	6.0E-2	3.1E-1	1.7E-1	1.2E-1	3.0E-1	13		
.0E0	0.0E0	5.9E-2	0.0E0	5.2E-2	7.1E-2	9.8E-2	1.3E-1	2.1E-1	1.5E-1	7.1E-2	1.5E-1	2.6E-1	14	
.6E-2	2.1E-1	3.4E-1	1.8E-1	2.6E-2	1.9E-2	1.4E-1	6.0E-2	3.1E-1	2.4E-2	1.9E-2	2.3E-1	4.1E-2	3.8E-2	15

16														
.5E-1	17													
.3E-2	1.4E-1	18												
.3E-2	2.3E-2	5.6E-2	19											
.0E-1	2.2E-1	2.0E-1	1.2E-1	20										
.4E-2	6.1E-3	2.1E-1	1.3E-2	1.9E-1	21									
.3E-2	4.1E-2	6.4E-2	8.6E-2	9.8E-2	2.4E-2	22								
.3E-2	2.3E-2	5.6E-2	2.2E-1	1.2E-1	1.3E-2	8.6E-2	23							
.4E-2	1.7E-3	8.0E-2	6.3E-2	9.6E-2	3.5E-2	1.1E-1	6.3E-2	24						
.3E-1	5.5E-2	1.8E-2	1.3E-1	1.0E-1	6.6E-2	1.2E-2	1.3E-1	1.6E-1	25					
.0E-2	1.0E-1	1.3E-1	3.2E-1	1.5E-2	9.1E-2	1.7E-1	3.2E-1	2.6E-2	2.2E-1	26				
.4E-2	8.2E-2	3.0E-1	1.1E-1	1.6E-1	4.6E-1	1.1E-2	1.1E-1	6.0E-2	3.2E-2	1.9E-1	27			
.1E-1	2.3E-2	5.6E-2	2.2E-1	7.7E-2	1.3E-2	8.6E-2	2.2E-1	6.3E-2	1.3E-1	3.2E-1	1.1E-1	28		
.4E-1	1.0E-2	3.6E-1	7.0E-2	1.5E-1	1.2E-1	4.9E-2	7.0E-2	3.9E-2	3.9E-3	1.5E-1	2.8E-2	3.4E-1	29	
.3E-1	5.5E-2	1.8E-2	1.3E-1	3.9E-2	1.0E-1	1.2E-2	1.3E-1	1.9E-2	5.5E-2	2.2E-1	3.2E-2	4.5E-1	2.0E-1	30

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
.0E-2	1.8E-2	3.1E-1	2.3E-1	2.1E-2	9.2E-2	1.1E-1	1.5E-1	3.2E-1	5.5E-3	2.3E-1	4.0E-1	3.1E-1	1.5E-1	3.7E-1	16
.0E-1	2.2E-2	1.1E-1	4.1E-2	1.7E-2	5.5E-2	2.3E-2	8.2E-2	2.4E-1	5.5E-2	5.5E-2	1.7E-2	9.1E-2	0.0E0	1.8E-1	17
.3E-1	1.3E-2	2.6E-1	2.3E-2	4.6E-2	1.8E-1	5.6E-2	1.4E-1	5.1E-2	2.1E-2	1.8E-2	1.1E-1	2.6E-2	5.2E-2	2.3E-1	18
.2E-1	1.6E-1	8.6E-2	4.4E-2	5.6E-2	1.3E-1	2.2E-1	1.1E-1	4.1E-3	1.1E-1	1.3E-1	1.3E-1	1.4E-1	9.8E-2	6.3E-2	19
.5E-2	2.7E-2	2.0E-2	1.5E-1	9.9E-2	3.9E-2	1.2E-1	1.6E-1	2.4E-2	2.5E-1	3.9E-2	3.7E-1	1.3E-1	3.7E-2	2.0E-1	20
.1E-2	3.4E-1	1.6E-1	1.8E-1	9.0E-2	1.0E-1	1.3E-2	2.1E-1	1.4E-1	8.4E-2	6.6E-2	2.1E-1	3.5E-2	4.4E-2	2.3E-1	21
.7E-1	4.3E-2	1.5E-1	7.9E-2	2.6E-1	1.2E-2	8.6E-2	1.1E-2	7.5E-3	2.0E-1	1.2E-2	1.1E-1	1.3E-1	5.9E-2	6.7E-3	22
.2E-1	1.6E-1	8.6E-2	4.4E-2	5.6E-2	1.3E-1	2.2E-1	1.1E-1	4.1E-3	8.3E-2	1.3E-1	7.0E-2	1.4E-1	9.8E-2	6.3E-2	23
.6E-2	1.2E-1	6.7E-3	1.7E-2	8.0E-2	1.9E-2	1.4E-1	6.0E-2	1.8E-2	5.2E-2	1.9E-2	2.1E-1	4.1E-2	1.9E-1	1.1E-1	24
.2E-1	8.5E-2	1.2E-2	3.2E-2	3.5E-1	5.5E-2	1.3E-1	2.7E-1	2.3E-1	9.2E-2	3.1E-1	2.5E-1	1.2E-1	7.1E-2	1.9E-2	25
.4E-1	2.6E-1	1.7E-1	1.2E-1	1.3E-1	2.2E-1	3.2E-1	1.9E-1	7.5E-2	1.0E-2	2.2E-1	2.1E-2	2.6E-2	0.0E0	2.6E-2	26
.9E-1	6.2E-2	1.1E-2	1.1E-1	4.3E-2	3.2E-2	1.1E-1	2.2E-1	3.1E-1	2.4E-2	3.2E-2	1.7E-1	6.0E-2	0.0E0	1.9E-1	27
.2E-1	1.6E-1	8.6E-2	4.4E-2	5.6E-2	1.3E-1	2.2E-1	1.1E-1	4.1E-3	8.3E-2	1.3E-1	1.3E-1	1.4E-1	9.8E-2	6.3E-2	28
.5E-1	2.7E-2	2.9E-1	1.9E-1	7.2E-2	3.9E-3	7.0E-2	2.8E-2	4.0E-2	2.9E-2	3.9E-3	1.7E-1	1.8E-1	0.0E0	1.8E-1	29
.2E-1	8.5E-2	1.2E-2	1.6E-1	1.8E-2	5.5E-2	1.3E-1	3.2E-2	7.4E-2	5.0E-2	5.5E-2	2.5E-1	1.2E-1	7.1E-2	1.9E-2	30

assage 1A: 1-tailed Fisher probabilities on recall of pairs of clauses

1														
.0E0	2													
.1E-1	3.0E-2	3												
.0E0	6.9E-2	2.2E-4	4											
.5E-1	3.9E-1	2.1E-1	1.2E-1	5										
.4E-2	1.0E0	3.8E-1	5.3E-1	4.8E-1	6									
.0E0	1.0E0	2.1E-1	3.1E-1	1.0E0	1.0E0	7								
.0E0	2.6E-1	8.9E-2	1.9E-1	1.5E-1	1.0E0	1.8E-1	8							
.0E0	6.0E-1	1.7E-1	4.1E-2	3.4E-1	2.7E-1	6.4E-2	1.3E-2	9						
.6E-1	4.4E-1	6.7E-2	1.6E-1	8.4E-2	9.2E-1	2.1E-1	1.3E-1	4.9E-1	10					
.0E0	1.0E0	1.0E0	1.0E0	1.0E-1	1.0E0	1.0E0	3.3E-1	2.7E-1	2.5E-1	11				
.3E-1	3.9E-1	5.1E-1	5.9E-1	2.0E-1	2.0E-1	6.8E-1	7.2E-1	5.6E-2	5.3E-1	2.0E-1	12			
.1E-1	8.0E-1	1.8E-1	8.8E-2	4.2E-1	1.8E-1	1.6E-1	3.2E-1	8.3E-3	9.9E-2	1.8E-1	1.0E-2	13		
.0E0	5.0E-1	6.7E-1	5.0E-1	6.5E-1	9.4E-1	2.5E-1	1.8E-1	5.9E-2	1.4E-1	9.4E-1	1.4E-1	2.6E-2	14	
.1E-1	6.2E-2	2.9E-3	8.8E-2	4.2E-1	5.4E-1	1.6E-1	3.2E-1	8.3E-3	4.3E-1	5.4E-1	4.0E-2	3.8E-1	6.1E-1	15

16														
.4E-1	17													
.7E-1	1.4E-1	18												
.2E-1	6.3E-1	2.8E-1	19											
.2E-1	4.9E-2	6.7E-2	1.9E-1	20										
.7E-1	5.4E-1	6.3E-2	4.0E-1	7.7E-2	21									
.7E-1	6.5E-1	6.4E-1	2.1E-1	2.3E-1	4.0E-1	22								
.2E-1	9.6E-1	2.8E-1	7.3E-2	1.9E-1	4.0E-1	2.1E-1	23							
.7E-1	4.9E-1	2.8E-1	3.5E-1	2.4E-1	4.0E-1	2.1E-1	8.4E-1	24						
.0E-2	3.9E-1	4.8E-1	1.4E-1	2.3E-1	6.5E-1	3.8E-1	1.4E-1	1.1E-1	25					
.6E-1	8.0E-1	1.5E-1	3.7E-2	4.4E-1	2.2E-1	1.1E-1	3.7E-2	5.9E-1	7.4E-2	26				
.3E-1	3.0E-1	1.9E-2	1.8E-1	1.1E-1	2.5E-4	4.6E-1	1.8E-1	6.8E-1	3.3E-1	9.3E-2	27			
.1E-1	9.6E-1	1.0E0	1.0E0	7.0E-1	4.0E-1	1.0E0	1.0E0	8.4E-1	1.0E0	1.0E0	1.0E0	28		
.2E-2	5.6E-1	6.3E-3	1.0E0	1.3E-1	1.8E-1	1.0E0	1.0E0	7.1E-1	1.0E0	1.0E0	5.1E-1	1.5E-2	29	
.0E-2	8.2E-1	1.0E0	1.0E0	6.1E-1	2.1E-1	1.0E0	1.0E0	8.2E-1	2.7E-1	1.0E0	3.3E-1	4.2E-3	7.7E-2	30

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
6E-1	4.4E-1	6.9E-3	4.3E-2	5.6E-1	2.5E-1	2.1E-1	1.3E-1	5.7E-3	5.2E-1	4.0E-2	5.3E-4	8.0E-3	1.4E-1	1.4E-3	16
.0E-1	9.0E-1	2.4E-1	7.4E-1	8.0E-1	3.9E-1	6.3E-1	3.0E-1	2.4E-2	3.5E-1	3.9E-1	4.5E-1	2.5E-1	7.5E-1	8.4E-2	17
5E-1	3.9E-1	3.6E-2	4.0E-1	3.4E-1	1.0E-1	1.0E0	1.5E-1	6.8E-1	5.6E-1	1.0E0	2.0E-1	7.2E-1	8.7E-1	4.1E-2	18
0E0	1.1E-1	2.1E-1	3.1E-1	2.8E-1	1.0E0	1.0E0	1.8E-1	4.5E-1	2.1E-1	1.0E0	1.8E-1	1.6E-1	2.5E-1	6.5E-1	19
4E-1	4.2E-1	5.5E-1	9.7E-1	2.3E-1	9.1E-1	1.9E-1	1.1E-1	4.3E-1	3.1E-2	6.1E-1	1.6E-3	1.7E-1	3.9E-1	6.5E-2	20
2E-1	8.9E-3	1.2E-1	9.8E-2	2.4E-1	2.1E-1	1.0E0	6.7E-2	1.5E-1	2.7E-1	1.0E0	5.7E-2	6.0E-1	6.3E-1	4.2E-2	21
0E0	3.0E-1	1.3E-1	2.6E-1	3.6E-2	1.0E0	1.0E0	4.6E-1	4.9E-1	6.7E-2	1.0E0	2.0E-1	1.8E-1	3.3E-1	4.7E-1	22
0E0	1.1E-1	2.1E-1	3.1E-1	2.8E-1	1.0E0	1.0E0	1.8E-1	4.5E-1	7.2E-1	1.0E0	6.8E-1	1.6E-1	7.5E-1	6.5E-1	23
0E0	2.0E-1	8.2E-1	7.3E-1	2.8E-1	8.2E-1	1.0E0	6.8E-1	6.9E-1	3.5E-1	4.6E-1	5.3E-2	8.1E-1	8.3E-2	2.1E-1	24
0E0	2.1E-1	3.8E-1	5.3E-1	8.4E-3	2.7E-1	1.0E0	3.9E-2	4.9E-2	2.5E-1	2.4E-2	2.8E-2	1.8E-1	3.1E-1	5.4E-1	25
0E0	5.6E-2	1.1E-1	1.7E-1	1.5E-1	1.0E0	1.0E0	9.3E-2	2.6E-1	4.6E-1	1.0E0	4.3E-1	4.1E-1	5.0E-1	4.1E-1	26
0E0	2.6E-1	4.6E-1	1.9E-1	5.7E-1	3.3E-1	1.0E0	6.2E-2	1.3E-2	4.3E-1	1.0E0	9.7E-2	6.9E-1	8.2E-1	8.2E-2	27
0E0	1.0E0	1.0E0	3.1E-1	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	7.2E-1	1.0E0	1.8E-1	1.6E-1	2.5E-1	1.0E0	28
3E-1	1.0E0	2.3E-2	8.1E-2	7.0E-1	4.4E-1	2.4E-1	5.1E-1	5.9E-1	4.1E-1	1.0E0	1.1E-1	8.8E-2	5.0E-1	8.8E-2	29
0E0	1.0E0	1.0E0	1.3E-1	4.8E-1	2.7E-1	1.0E0	1.0E0	7.1E-1	6.4E-1	2.7E-1	2.8E-2	1.8E-1	6.9E-1	5.4E-1	30

assage 1A: 'simplified' contingency coefficients

1																													
0	2																												
16	28	3																											
0	21	48	4																										
13	1	10	16	5																									
21	0	1	0	1	6																								
0	0	8	4	0	0	7																							
0	6	18	11	13	0	10	8																						
0	0	12	23	5	7	21	30	9																					
1	1	19	13	18	0	11	15	0	10																				
0	0	0	0	17	0	0	3	7	9	11																			
2	3	0	0	11	11	0	0	21	0	11	12																		
2	0	12	18	2	12	13	6	31	17	12	30	13																	
0	0	0	0	0	0	9	12	20	14	0	14	25	14																
2	20	34	18	2	0	13	6	31	2	0	23	4	0	15															
1	1	30	22	0	9	11	15	32	0	22	40	31	14	37	16														
0	0	10	0	0	5	0	8	23	5	5	1	9	0	18	14	17													
13	1	25	2	4	17	0	13	0	0	0	11	0	0	23	8	14	18												
0	16	8	4	5	0	0	10	0	11	0	12	13	9	0	0	0	5	19											
1	2	0	0	9	0	11	16	2	24	0	36	12	3	20	10	21	19	11	20										
9	33	16	17	9	10	0	20	13	8	0	21	0	0	23	8	0	21	1	19	21									
0	4	15	7	25	0	0	1	0	19	0	11	12	5	0	0	0	0	8	9	2	22								
0	16	8	4	5	0	0	10	0	0	0	0	13	0	0	0	0	5	21	11	1	8	23							
0	11	0	0	8	0	0	0	0	5	1	21	0	18	11	0	0	8	6	9	3	11	0	24						
0	8	1	0	35	5	0	26	22	9	30	24	12	7	0	22	5	1	13	10	0	1	13	16	25					
0	25	16	12	13	0	0	18	7	1	0	2	2	0	2	1	0	13	31	1	9	16	31	0	21	26				
0	6	1	11	0	3	0	22	30	2	0	17	0	0	18	2	8	30	10	16	46	1	10	0	3	18	27			
0	0	0	4	0	0	0	0	0	0	0	12	13	9	0	11	0	0	0	0	1	0	0	0	0	0	0	28		
14	0	28	19	0	0	7	0	0	2	0	16	18	0	18	24	0	35	0	15	12	0	0	0	0	0	0	34	29	
0	0	0	15	1	5	0	0	0	0	5	24	12	0	0	22	0	0	0	0	10	0	0	0	5	0	3	45	20	30

ssage 2C: recall (1) and omission (0) of clauses

jects \ Clauses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	1	0	1	0	1	0	0	1	1	1	0	1	1	1	0	1	1	0	0	1	1	1	0	0	1	0	1	1	1	1
2	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
3	1	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	1	0	1	0	1	0	0	1	0	1	1	1	1	1	0	1	1	1	1	0	0	1	0	1	1	0	1	1	1	1
5	1	1	1	0	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1
7	1	1	0	1	1	1	1	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1
8	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1	1	1	1	1
9	1	1	0	0	1	0	0	1	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
10	1	1	0	1	1	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1
11	1	1	1	1	1	0	0	0	1	1	1	1	1	1	0	1	1	0	0	0	0	1	1	0	1	0	1	1	1	0
12	1	0	1	0	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1
13	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
14	1	1	1	0	1	0	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
15	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
16	1	1	1	0	1	0	1	1	0	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	1	0	0	0
17	1	1	1	0	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
18	1	1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1
19	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
20	1	0	0	0	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
21	1	0	1	0	1	0	0	1	1	1	0	1	1	1	0	1	1	0	0	1	1	1	1	1	1	0	1	0	1	1
22	1	1	0	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1
23	1	1	0	1	1	0	0	1	0	1	0	1	0	0	1	1	1	0	0	0	0	1	1	1	0	0	1	0	1	1
24	1	1	1	0	1	0	0	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
25	1	1	0	1	1	0	0	1	0	1	1	1	1	1	0	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1
26	1	1	0	0	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	0	1	1	1	1
27	1	0	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	0	1	1
28	1	1	0	1	1	0	0	1	1	1	1	1	1	0	0	1	1	0	0	1	1	1	0	1	1	0	1	1	0	1
29	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
30	1	1	1	0	1	0	0	1	0	1	0	1	1	0	0	1	1	1	0	0	1	1	1	1	1	0	1	1	1	0
31	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1
32	1	0	1	0	1	0	0	1	0	1	0	1	0	0	0	1	1	1	1	0	0	1	1	1	1	0	1	0	1	1
33	1	1	1	0	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
34	1	1	0	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1
35	1	1	0	1	1	1	1	0	0	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1
36	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	0	1	1
37	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1
38	1	1	0	0	1	0	0	0	1	1	0	1	1	0	1	1	1	1	1	0	0	1	1	1	0	0	1	1	1	0
39	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1
40	1	1	1	1	1	0	0	1	0	1	1	1	1	1	0	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1
41	1	1	1	0	1	0	1	1	0	1	1	1	1	1	0	1	1	0	0	0	0	1	0	1	0	1	1	1	1	1
42	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	1	1	1	0	1	1	1
43	1	1	0	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
44	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	0	0	1	1	1	1	1	1	1	0	1	1
45	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1
46	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1
47	1	1	1	0	1	0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1
48	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
49	1	1	0	1	1	0	1	1	1	1	0	1	1	0	1	1	1	1	1	0	0	1	1	1	0	0	1	1	1	1
50	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
51	1	1	1	1	1	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
52	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1
53	1	0	0	1	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	0	1	1	0	0
54	1	1	0	1	1	0	0	1	0	1	1	1	1	1	0	1	1	0	0	0	1	0	1	1	1	0	1	0	1	1

assage 2C: contingency coefficients on recall of pairs of clauses

1														
.0E0	2													
.0E0	5.6E-2	3												
.0E0	1.2E-1	6.8E-2	4											
.0E0	1.1E-1	2.6E-2	5.1E-3	5										
.0E0	6.5E-2	6.8E-2	7.5E-2	5.1E-3	6									
.0E0	8.4E-2	9.3E-2	1.3E-2	4.9E-2	9.1E-2	7								
.0E0	7.0E-2	1.9E-1	1.2E-2	1.9E-1	1.2E-2	2.3E-2	8							
.0E0	6.0E-2	8.1E-2	3.0E-2	3.1E-2	3.0E-2	4.0E-2	5.8E-2	9						
.0E0	1.1E-1	2.6E-2	5.1E-3	4.4E-1	5.1E-3	4.9E-2	1.9E-1	3.1E-2	10					
.0E0	1.1E-1	1.7E-2	1.8E-1	1.2E-1	3.8E-1	1.6E-1	5.7E-2	0.0E0	1.2E-1	11				
.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	12			
.0E0	1.2E-2	4.6E-2	9.0E-3	2.6E-1	1.7E-1	8.5E-2	6.2E-2	1.1E-1	2.6E-1	4.0E-1	0.0E0	13		
.0E0	4.3E-2	1.4E-1	1.2E-1	1.1E-1	3.3E-1	1.7E-2	7.0E-2	3.8E-2	1.1E-1	4.4E-1	0.0E0	3.8E-1	14	
.0E0	3.6E-2	2.0E-1	2.5E-2	5.5E-2	5.5E-2	1.4E-2	1.0E-2	7.3E-2	5.5E-2	7.1E-2	0.0E0	7.7E-2	3.6E-2	15

16														
.0E0	17													
.0E0	0.0E0	18												
.0E0	0.0E0	4.5E-1	19											
.0E0	0.0E0	9.8E-3	9.3E-2	20										
.0E0	0.0E0	1.8E-2	4.4E-2	5.3E-1	21									
.0E0	0.0E0	5.6E-2	1.2E-2	1.3E-1	3.5E-2	22								
.0E0	0.0E0	2.6E-1	1.1E-1	1.1E-1	6.2E-2	8.6E-2	23							
0E0	0.0E0	7.2E-2	5.5E-2	5.8E-2	1.9E-2	7.0E-2	4.9E-2	24						
0E0	0.0E0	1.0E-1	1.1E-1	2.3E-1	3.0E-1	8.6E-2	3.1E-2	4.9E-2	25					
0E0	0.0E0	1.2E-1	2.0E-1	1.1E-2	1.3E-2	8.3E-2	3.3E-2	8.2E-2	1.5E-1	26				
0E0	0.0E0	5.6E-2	1.2E-2	1.3E-1	1.7E-1	2.2E-1	8.6E-2	7.0E-2	8.6E-2	8.3E-2	27			
0E0	0.0E0	3.4E-2	1.9E-2	2.0E-1	6.8E-2	4.2E-2	1.9E-1	4.3E-3	7.5E-2	2.3E-2	4.2E-2	28		
0E0	0.0E0	1.3E-2	1.2E-1	3.6E-2	8.5E-2	1.6E-1	4.3E-2	2.7E-2	4.3E-2	1.4E-1	1.6E-1	7.5E-2	29	
0E0	0.0E0	4.3E-2	1.6E-1	1.7E-1	2.3E-2	1.1E-1	1.1E-2	1.6E-1	1.1E-2	2.3E-1	1.1E-1	3.5E-2	3.2E-1	30

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	16
0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	17
0E0	2.5E-3	2.6E-2	3.7E-2	1.3E-1	3.6E-1	1.3E-1	4.3E-2	4.2E-2	1.3E-1	1.6E-1	0.0E0	1.3E-2	2.5E-3	1.1E-1	18
0E0	3.0E-2	3.3E-2	1.1E-1	6.8E-2	3.3E-1	4.4E-2	1.6E-2	2.8E-2	6.8E-2	1.1E-1	0.0E0	6.0E-2	3.0E-2	2.0E-2	19
0E0	2.1E-1	8.6E-2	3.2E-2	2.1E-2	1.8E-1	2.4E-1	4.8E-2	3.4E-2	2.1E-2	1.7E-1	0.0E0	2.0E-1	1.2E-1	1.0E-1	20
0E0	2.1E-1	1.3E-2	1.3E-2	4.9E-2	6.5E-2	1.2E-1	2.3E-2	2.0E-1	4.9E-2	5.3E-2	0.0E0	8.5E-2	1.7E-2	1.5E-1	21
0E0	3.3E-2	6.3E-2	1.0E-1	3.2E-1	1.0E-1	3.5E-2	1.1E-1	5.6E-2	3.2E-1	4.4E-2	0.0E0	1.6E-1	3.3E-2	2.7E-2	22
0E0	5.9E-2	6.7E-3	1.6E-1	1.7E-1	7.2E-2	6.2E-2	1.1E-2	2.0E-2	1.7E-1	7.9E-2	0.0E0	4.3E-2	5.9E-2	4.9E-2	23
0E0	1.7E-1	3.9E-2	1.2E-1	1.5E-1	1.4E-2	9.7E-2	2.8E-2	8.8E-2	1.5E-1	4.9E-2	0.0E0	2.7E-2	1.1E-1	3.5E-2	24
0E0	5.9E-2	1.3E-1	7.2E-2	1.7E-1	1.9E-1	6.2E-2	1.1E-2	2.0E-2	1.7E-1	2.3E-1	0.0E0	4.3E-2	2.1E-1	2.0E-1	25
0E0	1.1E-1	2.0E-1	3.4E-2	1.0E-2	3.2E-1	1.3E-2	1.0E-1	1.7E-2	1.0E-2	3.4E-1	0.0E0	1.4E-1	2.9E-1	3.0E-2	26
0E0	3.3E-2	1.4E-1	9.0E-2	3.2E-1	9.0E-2	3.5E-2	1.1E-1	1.4E-1	3.2E-1	4.4E-2	0.0E0	1.6E-1	3.3E-2	1.8E-1	27
0E0	1.8E-3	9.7E-2	1.0E-1	4.3E-2	2.7E-2	9.6E-2	3.5E-2	7.1E-2	4.3E-2	3.5E-2	0.0E0	7.5E-2	1.8E-3	1.2E-1	28
0E0	1.2E-2	4.6E-2	9.0E-3	2.6E-1	1.7E-1	8.5E-2	6.2E-2	5.5E-2	2.6E-1	0.0E0	0.0E0	1.2E-1	1.2E-2	7.7E-2	29
0E0	7.0E-2	6.0E-2	1.2E-2	1.9E-1	2.6E-1	2.3E-2	2.2E-1	5.8E-2	1.9E-1	1.1E-1	0.0E0	6.2E-2	9.4E-2	1.0E-2	30

ssage 2C: 1-tailed Fisher probabilities on recall of pairsof clauses

.														
0E0	2													
0E0	8.7E-1	3												
0E0	1.8E-1	8.5E-1	4											
0E0	1.9E-1	4.1E-1	1.0E0	5										
0E0	3.2E-1	3.1E-1	2.9E-1	4.8E-1	6									
0E0	2.7E-1	9.0E-1	5.4E-1	6.7E-1	2.5E-1	7								
0E0	1.0E0	8.2E-2	8.5E-1	1.0E0	8.0E-1	8.0E-1	8							
0E0	8.8E-1	2.8E-1	4.1E-1	6.1E-1	5.9E-1	8.1E-1	7.1E-1	9						
0E0	1.0E0	4.1E-1	5.2E-1	1.0E0	4.8E-1	6.7E-1	1.0E0	6.1E-1	10					
0E0	2.1E-1	5.4E-1	8.9E-2	1.0E0	5.9E-4	1.2E-1	6.1E-1	7.7E-1	1.7E-1	11				
0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	12			
0E0	4.7E-1	3.6E-1	5.3E-1	1.0E0	1.0E-1	2.9E-1	1.0E0	2.2E-1	5.6E-2	3.4E-3	1.0E0	13		
0E0	6.0E-1	1.5E-1	1.8E-1	1.0E0	3.9E-3	5.6E-1	6.6E-1	6.7E-1	1.9E-1	5.4E-4	1.0E0	4.8E-3	14	
0E0	6.1E-1	9.8E-1	6.6E-1	1.0E0	3.4E-1	7.6E-1	8.3E-1	2.9E-1	6.9E-1	9.0E-1	1.0E0	7.7E-1	6.1E-1	15

.6														
0E0	17													
0E0	1.0E0	18												
0E0	1.0E0	2.5E-4	19											
0E0	1.0E0	4.7E-1	2.5E-1	20										
0E0	1.0E0	5.4E-1	6.2E-1	1.2E-6	21									
0E0	1.0E0	2.8E-1	4.8E-1	1.8E-1	1.0E0	22								
0E0	1.0E0	3.6E-2	2.0E-1	2.0E-1	3.1E-1	1.0E0	23							
0E0	1.0E0	2.7E-1	6.4E-1	3.3E-1	7.5E-1	2.4E-1	5.8E-1	24						
0E0	1.0E0	2.1E-1	2.0E-1	4.4E-2	1.3E-2	1.0E0	5.2E-1	1.0E0	25					
0E0	1.0E0	1.8E-1	6.7E-2	6.8E-1	7.5E-1	7.9E-1	7.3E-1	2.8E-1	1.3E-1	26				
0E0	1.0E0	1.0E0	4.8E-1	1.8E-1	1.1E-1	1.0E0	2.1E-1	1.0E0	2.1E-1	7.9E-1	27			
0E0	1.0E0	5.9E-1	6.9E-1	9.8E-1	8.7E-1	5.8E-1	1.0E0	7.9E-1	9.4E-1	4.3E-1	1.0E0	28		
0E0	1.0E0	3.9E-1	1.8E-1	8.2E-1	1.0E0	1.0E0	3.0E-1	3.5E-1	1.0E0	1.5E-1	1.0E0	7.4E-1	29	
0E0	1.0E0	5.7E-1	1.2E-1	9.7E-2	5.5E-1	1.0E0	1.0E0	1.2E-1	4.6E-1	3.8E-2	1.0E0	9.0E-1	2.0E-2	30

.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	16
0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	17
0E0	4.6E-1	4.2E-1	6.9E-1	1.0E0	1.5E-3	1.7E-1	5.7E-1	8.6E-1	1.0E0	1.2E-1	1.0E0	3.9E-1	4.6E-1	2.1E-1	18
0E0	5.7E-1	4.0E-1	9.2E-1	1.0E0	4.1E-3	6.3E-1	4.3E-1	4.2E-1	1.0E0	2.0E-1	1.0E0	6.3E-1	5.7E-1	4.5E-1	19
0E0	5.7E-2	2.6E-1	7.8E-1	4.3E-1	9.1E-2	3.1E-2	3.6E-1	4.0E-1	4.3E-1	1.1E-1	1.0E0	7.1E-2	1.9E-1	9.1E-1	20
0E0	5.6E-2	4.6E-1	6.8E-1	1.0E0	3.2E-1	1.8E-1	5.5E-1	9.8E-1	1.0E0	3.4E-1	1.0E0	2.5E-1	4.4E-1	9.6E-1	21
0E0	1.0E0	6.5E-1	1.0E0	1.0E0	2.3E-1	4.4E-1	1.0E0	3.7E-1	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	4.7E-1	22
0E0	3.1E-1	4.7E-1	1.1E-1	1.0E0	3.0E-1	3.4E-1	4.6E-1	8.5E-1	1.0E0	6.8E-1	1.0E0	1.0E0	7.3E-1	7.2E-1	23
0E0	1.1E-1	8.7E-1	9.6E-1	1.3E-1	4.6E-1	2.5E-1	5.1E-1	9.3E-1	1.0E0	7.4E-1	1.0E0	1.0E0	1.0E0	6.2E-1	24
0E0	7.3E-1	1.8E-1	9.2E-1	1.0E0	8.0E-2	9.1E-1	4.6E-1	8.5E-1	1.0E0	5.1E-2	1.0E0	3.0E-1	7.0E-2	9.9E-1	25
0E0	2.2E-1	6.7E-2	6.2E-1	5.4E-1	6.2E-3	6.8E-1	2.3E-1	7.5E-1	5.4E-1	1.9E-3	1.0E0	1.5E-1	1.1E-2	5.8E-1	26
0E0	3.4E-1	1.6E-1	7.7E-1	1.0E0	7.4E-1	8.9E-1	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	27
0E0	7.7E-1	9.0E-1	9.1E-1	1.0E0	6.4E-1	9.0E-1	9.0E-1	3.0E-1	1.0E0	3.9E-1	1.0E0	2.8E-1	7.7E-1	1.8E-1	28
0E0	4.7E-1	3.6E-1	9.0E-1	5.6E-2	1.0E-1	7.5E-1	1.0E0	6.7E-1	1.0E0	1.0E0	1.0E0	1.0E0	4.7E-1	7.7E-1	29
0E0	6.6E-1	6.9E-1	5.4E-1	9.3E-2	2.1E-2	4.5E-1	6.2E-2	7.1E-1	1.0E0	1.9E-1	1.0E0	1.0E0	2.3E-1	8.3E-1	30

ssage 2C: 'simplified' contingency coefficients

1																													
0	2																												
0	0	3																											
0	12	0	4																										
0	11	2	0	5																									
0	6	6	7	0	6																								
0	8	0	0	0	9	7																							
0	0	18	0	0	0	0	8																						
0	0	8	2	0	0	0	0	9																					
0	0	2	0	0	0	0	0	0	10																				
0	10	0	17	0	38	15	0	0	12	11																			
0	0	0	0	0	0	0	0	0	0	0	12																		
0	1	4	0	0	16	8	0	10	25	39	0	13																	
0	0	13	12	0	33	0	0	0	11	44	0	37	14																
0	0	0	0	0	5	0	0	7	0	0	0	0	0	15															
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16														
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17													
0	0	2	0	0	35	12	0	0	0	16	0	1	0	11	0	0	18												
0	0	3	0	0	33	0	1	2	0	11	0	0	0	1	0	0	44	19											
0	21	8	0	2	17	24	4	3	2	16	0	19	11	0	0	0	0	9	20										
0	21	1	0	0	6	12	0	0	0	5	0	8	1	0	0	0	0	0	52	21									
0	0	0	0	0	10	3	0	5	0	0	0	0	0	2	0	0	5	1	12	0	22								
0	5	0	16	0	7	6	1	0	0	0	0	0	0	0	0	0	25	10	11	6	0	23							
0	16	0	0	14	1	9	0	0	0	0	0	0	0	0	0	0	7	0	5	0	7	0	24						
0	0	12	0	0	18	0	1	0	0	23	0	4	20	0	0	0	10	10	22	29	0	0	0	25					
0	10	19	0	0	31	0	10	0	0	34	0	14	28	0	0	0	12	19	0	0	0	0	8	14	26				
0	3	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	12	17	0	8	0	8	0	27			
0	0	0	0	0	0	0	0	7	0	3	0	7	0	12	0	0	0	0	0	0	0	0	0	0	2	0	28		
0	1	4	0	25	16	0	0	0	0	0	0	0	1	0	0	0	1	11	0	0	0	4	2	0	14	0	0	29	
0	0	0	0	18	25	2	22	0	0	11	0	0	9	0	0	0	0	15	17	0	0	0	15	1	22	0	0	32	30

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ssage 3B: recall (1) and omission (0) of clauses

	Clauses																													
jects	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	1	1	1	1	1	1	0	0	1	1	1	1	0	1	0	0	1	1	1	0	0	0	0	0	0	1	1	0	1	1
2	1	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	1	0	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1
5	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0	1	1
7	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
8	1	1	0	1	1	1	0	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	1
9	0	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	0	1	1	1	1	1	1	1	0	1	1	0	1	1
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
11	1	1	1	1	1	0	0	0	1	0	0	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0	1	0	1	1
12	1	1	1	1	1	0	0	1	1	1	1	1	0	0	0	0	0	1	0	0	1	1	1	0	0	1	1	1	0	1
13	1	1	0	1	1	0	0	0	1	1	1	1	0	1	1	1	0	1	0	0	1	1	1	1	0	0	0	0	0	1
14	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
16	1	1	0	0	1	1	0	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
17	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0	1	1
18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
19	1	1	1	1	1	0	0	1	1	1	1	1	0	1	1	1	1	0	0	0	1	1	1	1	0	1	1	0	1	1
20	1	0	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1	1	0	1	1
21	1	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1
22	1	0	1	1	1	1	0	0	0	1	0	0	1	0	1	0	1	1	1	1	1	0	1	0	0	0	0	0	0	1
23	1	0	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	0	0	1	1	0	0	1
24	1	0	1	1	1	1	0	0	1	1	0	0	0	1	1	0	0	1	0	0	1	1	1	0	0	1	0	0	0	1
25	1	1	0	1	1	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	1	1	1	1	0	1	1	0	0	1
26	0	1	0	1	1	1	0	0	1	0	1	0	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	0	0	1
27	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	0	0	1
28	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	0	0	1	0	0	1	0	1	1	0	1	1	0	0	1
29	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
30	1	0	0	1	1	1	0	0	1	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
31	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1
32	1	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
33	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	0	1	1	0	1	1
34	1	0	1	1	1	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	0	1	1	0	1	1
35	1	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1
36	1	1	0	1	0	0	0	0	1	1	0	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1
37	1	0	0	1	1	1	0	0	0	1	1	1	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	0	1	1
38	1	1	0	1	1	1	1	0	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1
39	1	0	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	1
40	1	1	1	1	1	1	0	1	1	0	1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
41	1	1	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	0	1
42	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
43	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	0	0	1	0	1	1	1	0	0	0	0	1
44	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	0	0	1
45	1	1	1	1	1	1	0	0	1	1	1	0	0	1	1	0	1	0	0	0	1	1	0	1	0	1	1	0	0	1
46	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	1	1
47	1	1	1	1	1	0	0	0	0	1	0	0	1	1	1	1	1	1	0	0	1	1	1	1	0	1	1	0	1	1
48	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1
49	1	0	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0	0	0	0	1
50	1	1	1	1	1	1	0	0	1	1	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
51	1	1	1	1	0	0	0	0	0	1	0	1	1	1	1	0	1	0	0	0	1	1	1	1	1	1	1	1	0	1
52	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
53	1	1	1	1	1	1	0	0	1	1	1	1	0	1	1	1	0	1	0	0	1	1	1	1	0	1	1	1	1	1
54	1	1	1	1	1	1	0	0	1	1	1	0	0	1	1	1	0	1	1	1	1	0	0	0	1	0	1	0	1	1

ssage 3B: contingency coefficients on recall of pairs of clauses

1															
1E-3	2														
.9E-1	2.1E-1	3													
6E-1	1.3E-1	2.7E-1	4												
3E-1	7.4E-2	4.9E-2	8.5E-2	5											
3E-2	3.9E-2	5.4E-3	3.2E-2	1.0E-1	6										
0E-2	1.5E-1	2.0E-1	6.9E-2	1.1E-1	2.9E-1	7									
3E-2	3.2E-1	3.0E-1	1.4E-1	5.0E-2	1.8E-1	4.4E-1	8								
6E-2	5.1E-2	1.3E-1	1.3E-2	1.8E-1	9.0E-2	9.9E-2	2.2E-1	9							
6E-2	5.1E-2	1.3E-1	1.3E-2	1.8E-2	3.5E-2	1.5E-2	2.1E-2	4.6E-2	10						
2E-2	5.8E-2	1.8E-1	1.2E-1	6.1E-2	2.1E-1	1.7E-1	3.5E-1	3.6E-1	2.6E-1	11					
9E-2	1.1E-1	4.8E-2	2.3E-1	2.7E-3	1.8E-1	3.6E-2	1.3E-1	5.0E-2	1.6E-1	1.6E-1	12				
0E-2	1.9E-1	1.8E-1	1.5E-1	6.0E-2	1.5E-1	6.4E-2	1.1E-1	3.7E-2	3.7E-2	2.3E-2	2.3E-1	13			
4E-2	1.3E-1	2.9E-1	2.1E-1	1.6E-1	6.0E-2	1.8E-2	6.6E-2	1.6E-1	2.3E-2	2.2E-1	1.2E-1	1.8E-1	14		
6E-2	7.5E-3	9.3E-2	4.3E-2	1.2E-2	2.4E-2	3.6E-2	3.3E-2	6.4E-2	1.0E-1	1.1E-1	3.4E-2	2.7E-1	4.8E-1	15	

16															
5E-1	17														
4E-1	4.0E-2	18													
2E-1	2.2E-1	5.6E-1	19												
6E-1	1.7E-1	5.3E-1	6.7E-1	20											
1E-1	5.8E-2	1.1E-1	0.0E0	1.0E-1	21										
9E-2	9.1E-3	1.4E-2	7.9E-2	5.0E-2	3.7E-1	22									
4E-1	9.1E-2	7.4E-2	4.2E-2	1.6E-3	4.2E-1	1.9E-1	23								
1E-1	1.2E-1	1.2E-1	3.9E-2	6.6E-2	3.6E-1	3.1E-1	4.0E-1	24							
1E-1	5.2E-2	1.2E-1	2.9E-1	3.4E-1	1.9E-1	9.1E-3	4.8E-3	2.0E-1	25						
9E-2	1.8E-1	7.4E-2	2.1E-1	1.7E-1	3.0E-2	1.9E-1	8.4E-2	2.5E-1	8.2E-2	26					
4E-1	2.6E-1	1.6E-1	2.8E-1	2.4E-1	1.7E-1	1.9E-1	8.4E-2	3.2E-1	1.7E-1	6.0E-1	27				
4E-1	2.0E-1	2.0E-1	2.7E-1	3.1E-1	1.6E-1	9.8E-2	1.0E-1	2.8E-1	2.7E-1	3.5E-1	3.5E-1	28			
9E-1	3.2E-1	2.2E-1	3.2E-1	2.5E-1	1.4E-1	1.0E-1	2.0E-2	2.9E-1	1.9E-1	3.7E-1	5.0E-1	3.8E-1	29		
1E-2	3.1E-2	4.9E-2	0.0E0	1.0E-2	1.9E-1	5.5E-2	7.5E-2	4.9E-2	3.1E-2	7.5E-2	7.5E-2	4.9E-2	5.1E-3	30	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
3E-2	2.4E-1	9.2E-2	1.6E-1	1.0E-1	1.8E-2	2.0E-1	1.8E-1	2.1E-1	9.0E-2	2.1E-1	1.9E-1	2.8E-1	4.7E-1	5.1E-1	16
4E-1	9.1E-2	4.6E-1	5.5E-2	8.1E-3	7.6E-2	1.4E-1	1.7E-1	1.5E-1	2.5E-1	2.2E-1	5.7E-2	2.6E-1	2.9E-1	2.5E-1	17
5E-2	7.4E-2	1.8E-1	8.5E-2	1.7E-1	2.3E-1	1.6E-1	6.6E-2	9.2E-2	1.8E-2	1.3E-1	1.4E-2	1.4E-1	5.3E-2	6.2E-2	18
8E-2	4.2E-2	4.1E-2	0.0E0	7.1E-2	4.4E-1	2.0E-1	1.5E-1	1.5E-1	5.2E-2	2.4E-1	3.8E-2	1.1E-1	9.9E-2	5.9E-2	19
1E-1	8.3E-2	7.5E-3	1.8E-2	5.0E-2	4.1E-1	1.7E-1	2.1E-1	1.2E-1	2.1E-2	2.0E-1	9.5E-2	4.0E-2	6.6E-2	1.5E-1	20
1E-1	3.0E-2	2.6E-3	6.2E-2	2.7E-1	9.3E-2	1.4E-1	1.0E-1	4.3E-2	4.3E-2	1.6E-2	8.5E-2	1.2E-1	5.7E-2	1.1E-2	21
7E-2	9.9E-2	4.7E-2	7.7E-2	1.9E-1	2.1E-1	4.0E-2	5.0E-2	2.1E-3	2.1E-3	2.0E-2	9.9E-2	2.5E-2	7.1E-2	4.9E-2	22
1E-3	1.2E-2	3.3E-2	5.1E-2	2.3E-1	1.6E-1	1.5E-1	1.7E-1	5.1E-2	1.7E-1	3.7E-2	2.8E-1	1.9E-1	1.9E-2	7.5E-3	23
5E-2	2.5E-1	1.4E-2	8.5E-2	1.7E-1	4.7E-2	2.4E-1	2.2E-1	1.8E-2	1.8E-2	4.4E-2	1.5E-1	1.3E-2	2.5E-1	1.8E-1	24
6E-2	1.7E-1	1.4E-1	1.1E-1	8.1E-3	2.8E-1	4.0E-1	4.0E-1	6.5E-2	4.2E-2	1.9E-1	2.2E-2	1.8E-1	1.0E-1	2.0E-2	25
1E-3	1.2E-2	3.3E-2	5.1E-2	7.4E-2	2.4E-1	2.4E-1	1.7E-1	5.1E-2	5.1E-2	2.4E-1	2.8E-2	6.4E-2	1.3E-1	7.5E-3	26
1E-3	1.8E-1	1.2E-1	5.1E-2	7.4E-2	1.4E-1	2.4E-1	1.7E-1	5.1E-2	5.1E-2	2.4E-1	1.1E-1	2.0E-2	1.3E-1	7.5E-3	27
5E-2	1.9E-1	1.6E-1	8.5E-2	2.5E-2	1.4E-1	1.8E-1	3.1E-1	1.3E-1	1.8E-2	1.3E-1	1.4E-2	1.3E-2	1.6E-1	6.2E-2	28
0E-2	6.4E-2	2.2E-1	9.0E-3	2.2E-1	2.4E-1	2.5E-1	2.5E-1	1.7E-1	6.7E-2	1.9E-1	6.7E-2	1.4E-3	3.8E-1	1.9E-1	29
2E-1	7.5E-2	6.1E-2	2.6E-1	2.2E-1	9.1E-2	6.1E-2	1.0E-2	1.3E-1	1.3E-1	6.8E-2	3.7E-2	5.1E-3	1.2E-1	1.7E-1	30

ssage 3B: 1-tailed Fisher probabilities on recall of pairs of clauses

1														
5E-1	2													
4E-2	5.7E-2	3												
0E0	1.6E-1	2.3E-2	4											
0E0	7.1E-1	3.4E-1	2.1E-1	5										
0E0	6.6E-1	5.0E-1	5.4E-1	2.1E-1	6									
9E-1	1.3E-1	6.8E-2	3.4E-1	2.3E-1	7.9E-3	7								
8E-1	5.3E-3	8.6E-3	1.5E-1	3.6E-1	8.7E-2	9.0E-5	8							
0E0	3.4E-1	1.7E-1	3.9E-1	1.0E-1	2.4E-1	2.4E-1	4.2E-2	9						
8E-1	6.8E-1	1.7E-1	1.0E0	1.0E0	5.8E-1	5.6E-1	4.4E-1	3.4E-1	10					
8E-1	3.3E-1	8.8E-2	1.8E-1	3.1E-1	6.0E-2	9.5E-2	2.6E-3	3.8E-3	3.0E-2	11				
1E-1	2.0E-1	3.6E-1	4.6E-2	8.5E-1	9.8E-1	6.4E-1	1.6E-1	6.3E-1	1.1E-1	1.1E-1	12			
7E-1	8.1E-2	9.4E-2	1.3E-1	7.2E-1	9.6E-1	3.2E-1	2.1E-1	6.9E-1	4.0E-1	5.7E-1	3.8E-2	13		
0E0	1.6E-1	1.4E-2	6.9E-2	1.3E-1	3.1E-1	4.6E-1	3.2E-1	1.2E-1	4.0E-1	5.6E-2	1.9E-1	8.9E-2	14	
0E0	4.9E-1	2.4E-1	3.0E-1	1.0E0	4.0E-1	4.2E-1	7.3E-1	6.4E-1	2.1E-1	2.0E-1	7.3E-1	1.5E-2	2.2E-4	15

16														
0E-2	17													
5E-1	3.8E-1	18												
0E-2	4.6E-2	4.8E-8	19											
0E-2	1.1E-1	3.6E-7	2.1E-13	20										
7E-2	6.5E-1	2.0E-1	5.0E-1	2.3E-1	21									
0E-1	7.5E-1	7.6E-1	8.8E-1	8.3E-1	2.0E-3	22								
5E-1	2.5E-1	2.9E-1	8.2E-1	7.4E-1	6.3E-4	8.3E-2	23							
6E-3	1.9E-1	1.8E-1	3.9E-1	3.2E-1	2.7E-3	9.2E-3	8.7E-4	24						
2E-1	3.5E-1	1.9E-1	1.2E-2	3.5E-3	7.5E-2	7.1E-1	7.5E-1	6.8E-2	25					
6E-1	9.6E-2	2.9E-1	5.9E-2	1.1E-1	3.9E-1	8.3E-2	2.6E-1	3.3E-2	2.8E-1	26				
5E-1	2.7E-2	1.1E-1	1.4E-2	3.0E-2	1.0E-1	8.3E-2	2.6E-1	6.5E-3	1.1E-1	2.2E-8	27			
5E-1	6.8E-2	6.0E-2	2.1E-2	7.6E-3	1.2E-1	2.4E-1	2.2E-1	1.3E-2	1.9E-2	1.2E-3	1.2E-3	28		
6E-4	6.7E-3	5.0E-2	6.7E-3	2.6E-2	1.5E-1	2.2E-1	5.6E-1	1.3E-2	7.2E-2	1.2E-3	3.0E-6	1.1E-3	29	
2E-1	3.9E-1	3.3E-1	5.0E-1	5.4E-1	9.3E-2	3.1E-1	2.6E-1	3.3E-1	6.1E-1	1.0E0	1.0E0	6.7E-1	4.8E-1	30

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
0E0	4.1E-2	2.4E-1	1.2E-1	2.1E-1	5.3E-1	6.4E-2	8.7E-2	6.3E-2	2.4E-1	6.0E-2	8.3E-2	1.4E-2	1.3E-4	3.6E-5	16
5E-1	2.5E-1	5.6E-5	3.3E-1	5.1E-1	2.9E-1	1.5E-1	1.1E-1	1.4E-1	3.1E-2	4.9E-2	3.4E-1	2.1E-2	1.3E-2	2.8E-2	17
0E0	2.9E-1	8.7E-2	2.5E-1	1.0E-1	4.4E-2	1.2E-1	3.2E-1	2.4E-1	5.4E-1	1.7E-1	7.6E-1	9.5E-1	3.4E-1	6.6E-1	18
0E0	3.8E-1	3.8E-1	5.0E-1	3.1E-1	5.1E-5	6.7E-2	1.4E-1	1.3E-1	3.5E-1	3.3E-2	8.0E-1	9.1E-1	2.3E-1	3.3E-1	19
0E0	2.7E-1	5.2E-1	5.6E-1	3.6E-1	1.5E-4	1.1E-1	5.4E-2	1.8E-1	4.4E-1	6.7E-2	9.0E-1	8.0E-1	3.2E-1	1.3E-1	20
0E0	3.9E-1	4.7E-1	2.6E-1	3.9E-2	1.0E0	1.6E-1	2.3E-1	5.7E-1	5.7E-1	8.2E-1	2.6E-1	2.0E-1	6.1E-1	4.6E-1	21
0E0	2.3E-1	8.4E-1	6.9E-1	8.7E-2	9.9E-1	8.3E-1	8.3E-1	4.9E-1	7.9E-1	7.9E-1	2.3E-1	5.7E-1	2.9E-1	6.2E-1	22
0E0	5.2E-1	4.0E-1	6.0E-1	4.9E-2	9.8E-1	1.3E-1	1.1E-1	6.8E-1	1.1E-1	6.0E-1	1.7E-2	8.1E-2	4.3E-1	4.9E-1	23
0E0	3.3E-2	7.0E-1	2.5E-1	1.0E-1	3.6E-1	3.3E-2	4.9E-2	8.3E-1	8.3E-1	3.7E-1	1.4E-1	4.6E-1	2.9E-2	8.7E-2	24
7E-1	1.1E-1	1.5E-1	2.2E-1	4.9E-1	1.3E-2	6.3E-4	5.2E-4	3.2E-1	6.3E-1	7.1E-2	6.6E-1	9.1E-2	2.3E-1	5.7E-1	25
0E0	5.2E-1	4.0E-1	6.0E-1	2.7E-1	4.1E-2	3.0E-2	1.1E-1	6.8E-1	6.8E-1	3.8E-2	4.1E-1	8.6E-1	1.6E-1	4.9E-1	26
0E0	9.5E-2	1.8E-1	6.0E-1	2.7E-1	1.5E-1	3.0E-2	1.1E-1	6.8E-1	6.8E-1	3.8E-2	2.0E-1	6.8E-1	1.6E-1	4.9E-1	27
4E-1	7.3E-2	1.2E-1	7.5E-1	5.9E-1	1.5E-1	8.7E-2	7.6E-3	1.7E-1	4.6E-1	1.7E-1	4.6E-1	5.4E-1	1.2E-1	3.4E-1	28
4E-1	3.2E-1	4.7E-2	4.7E-1	4.7E-2	3.6E-2	2.7E-2	2.6E-2	1.0E-1	3.1E-1	8.3E-2	3.1E-1	7.0E-1	5.9E-4	8.0E-2	29
0E0	2.6E-1	3.0E-1	5.6E-2	7.4E-2	1.0E0	7.0E-1	5.4E-1	1.5E-1	1.0E0	1.0E0	3.7E-1	5.2E-1	1.7E-1	1.0E0	30

ssage 3B: 'simplified' contingency coefficients

1																													
0	**2**																												
9	21	**3**																											
0	13	27	**4**																										
0	0	4	8	**5**																									
0	0	0	0	10	**6**																								
1	15	19	6	10	28	**7**																							
8	31	30	14	4	18	44	**8**																						
0	5	12	1	17	9	9	22	**9**																					
5	0	12	0	0	0	0	2	4	**10**																				
1	5	18	11	6	21	17	34	35	25	**11**																			
0	11	4	22	0	0	0	13	0	16	16	**12**																		
0	18	17	15	0	0	6	10	0	3	0	23	**13**																	
0	13	29	21	15	5	1	6	16	2	21	11	17	**14**																
0	0	9	4	0	2	3	0	0	10	10	0	27	48	**15**															
0	23	9	15	10	0	19	18	21	9	21	18	28	47	50	**16**														
4	9	46	5	0	7	14	16	14	24	22	5	26	29	25	25	**17**													
0	7	18	8	17	22	15	6	9	0	13	0	0	5	0	14	4	**18**												
0	4	4	0	7	44	19	14	15	5	24	0	0	9	5	21	22	55	**19**											
0	8	0	0	4	41	16	21	12	2	19	0	0	6	14	26	16	52	66	**20**										
0	2	0	6	26	0	13	10	0	0	0	8	11	0	1	20	0	11	0	10	**21**									
0	9	0	0	18	0	0	0	0	0	0	9	0	7	0	6	0	0	0	0	37	**22**								
0	0	3	0	22	0	15	16	0	16	0	27	18	1	0	13	9	7	0	0	42	18	**23**							
0	24	0	8	17	4	23	21	0	0	4	14	1	25	18	31	12	12	3	6	35	30	39	**24**						
5	16	14	10	0	27	40	40	6	0	19	0	17	10	0	10	5	12	29	34	18	0	0	19	**25**					
0	0	3	0	7	23	23	16	0	0	23	2	0	13	0	0	17	7	20	16	2	18	8	24	8	**26**				
0	17	12	0	7	13	23	16	0	0	23	11	0	13	0	13	25	16	28	24	17	18	8	32	16	60	**27**			
3	19	15	0	0	14	18	31	12	1	13	1	0	15	6	14	19	20	26	31	15	9	10	27	27	34	34	**28**		
0	6	22	0	21	23	25	25	16	6	18	6	0	38	18	38	31	21	31	25	13	10	0	28	19	37	49	37	**29**	
0	7	6	25	21	0	0	0	13	0	0	3	0	12	0	9	3	4	0	0	18	5	7	4	0	0	0	0	0	**30**

APPENDIX 5.6: EXPERIMENTS I AND II: PASSAGES 1A, 2C AND 3B: QUALITATIVE ANALYSIS OF CLAUSE ASSOCIATIONS

The following list of clause pairs (from Tables 6.4-6.6), indicated by the serial numbers of the two clauses involved, attempts to describe for each pair the likely relationship, if any, connecting the clauses. Broadly speaking, the main categorisation is in terms of causal and non-causal thematic, with a bias towards counting a relation as causal in borderline cases. Certain subdivisions within these two groupings have been indicated, though these have little status, and an additional category 'consecutive' has been developed for Passage 1A. The various distinctions are described as follows:

CAUSAL: these clause pairs usually show either a CAUSE-EFFECT relation (more or less necessary) or a LIKELY relation (where one clause specifies a possible but by no means necessary outcome of the event in the other). The cause is not necessarily contained in the earlier clause of the pair. A third, INDIRECT, type of causal link is also indicated in a few cases: this is where some sort of causal relation exists between the two clauses only if another clause is taken into account. Some INDIRECT associations may be statistical artefacts caused by two of the pairings of three clauses having high contingency coefficients which then produces a spurious coefficient for the third pairing.

THEMATIC: these relations are thematic ones *that are not obviously causal*. There is always repetition of topic or content, either explicit or implicit, and again several types were distinguished. REPETITION types contain roughly the same information, albeit in a different context. SIMILARITY relations are like REPETITION's, but with much reduced actual repetition; they are often very tentative. In QUALIFICATION relations one clause simply adds to, refines or describes further the content of the other clause. Finally, in COMPONENTS relations the two clauses each describe a different aspect of the same object, activity etc.

CONSECUTIVE relations were a peculiar type that occurred only for Passage 1A. These relations were described between two clauses which formed consecutive elements in a sequence of events, and though their order was usually but not always unambiguous, it was difficult to assert that one was causally dependent upon the other in any way. In all cases there were several clauses between the CONSECUTIVE ones which may sometimes have given a weak INDIRECT CAUSAL relation to the pair. Alternatively, it would not be difficult to place a weak COMPONENTS THEMATIC relation between many of these clauses.

UNKNOWN: these clause pairs seemed to the Experimenter to have no obvious relation connecting them, except by the application of unjustifiable amounts of imagination. Most are probably the products of random factors or odd associations between other clauses.

In the table below, an attempt has been made to assign each clause pair as far as possible to one of the above categories. Uncertainty is indicated by question marks and the suggestion of a less favoured alternative in brackets. Some of the difficulty in this task is illustrated by the very large numbers of clauses in Passages 1A and 2C which all contain the same main object or actor: in Passage 1A, 'Ernu' is mentioned explicitly or implicitly in all but 4 clauses and the armadillo in about 15 clauses; in Passage 2C, the narrator is referred to in perhaps 17 of the 30 clauses.

* indicates adjacent clauses

\+ indicates 1 or 2 intervening clauses

PASSAGE 1A

Clauses	Type of relationship
2/21:	UNKNOWN
* 3/4:	? THEMATIC (COMPONENTS)
3/15:	UNKNOWN
3/16:	UNKNOWN
5/25:	UNKNOWN
* 8/9:	CAUSAL (LIKELY)
9/13:	CONSECUTIVE
9/15:	CONSECUTIVE
9/16:	CONSECUTIVE
9/27:	UNKNOWN
11/25:	UNKNOWN
* 12/13:	CAUSAL (CAUSE-EFFECT)
12/16:	CONSECUTIVE; ? CAUSAL (LIKELY)
12/20:	UNKNOWN
+ 13/16:	CONSECUTIVE
* 15/16:	? CAUSAL (LIKELY); ? CONSECUTIVE
18/27:	UNKNOWN
18/29:	UNKNOWN
19/26:	? CAUSAL (CAUSE-EFFECT)
21/27:	? CONSECUTIVE; ? CAUSAL (LIKELY)
+ 23/26:	? CONSECUTIVE; ? CAUSAL (LIKELY)
* 28/29:	CAUSAL (CAUSE-EFFECT)
+ 28/30:	CAUSAL (CAUSE-EFFECT)

PASSAGE 2C

Clauses	Type of relationship
6/11:	UNKNOWN
6/14:	UNKNOWN
6/18:	THEMATIC (REPETITION)
6/19:	UNKNOWN
6/26:	? THEMATIC (SIMILARITY)
+ 11/13:	UNKNOWN
* 11/14:	UNKNOWN
11/26:	UNKNOWN
* 13/14:	THEMATIC (QUALIFICATION)
* 18/19:	? CAUSAL (CAUSE-EFFECT)
* 20/21:	? CAUSAL (LIKELY); ? THEMATIC (COMPONENTS)
* 29/30:	? THEMATIC (COMPONENTS); ? CAUSAL (LIKELY)

PASSAGE 3B

Clauses	Type of relationship
2/8:	UNKNOWN
3/8:	UNKNOWN
3/17:	? THEMATIC (SIMILARITY)
6/19:	? CAUSAL (CAUSE-EFFECT)
6/20:	UNKNOWN
* 7/8:	? THEMATIC (COMPONENTS); ? CAUSAL (LIKELY)
7/25:	UNKNOWN
+ 8/11:	UNKNOWN
8/25:	UNKNOWN
8/28:	UNKNOWN
+ 9/11:	? THEMATIC (SIMILARITY)
* 14/15:	CAUSAL (CAUSE-EFFECT);
+ 14/16:	? THEMATIC (SIMILARITY); ? CAUSAL (INDIRECT)
14/29:	UNKNOWN
* 15/16:	CAUSAL (CAUSE-EFFECT)
16/24:	UNKNOWN
16/29:	UNKNOWN
17/29:	UNKNOWN
* 18/19:	? THEMATIC (QUALIFICATION); ? CAUSAL (INDIRECT)
+ 18/20:	? THEMATIC (QUALIFICATION); ? CAUSAL (INDIRECT)
* 19/20:	CAUSAL (CAUSE-EFFECT)
19/29:	? THEMATIC (SIMILARITY)
20/25:	UNKNOWN
20/28:	UNKNOWN
* 21/22:	? THEMATIC (REPETITION); ? CAUSAL (? LIKELY; ? INDIRECT)
+ 21/23:	CAUSAL (LIKELY)
+ 21/24:	? CAUSAL (INDIRECT)
+ 22/24:	? CAUSAL (INDIRECT)
* 23/24:	? THEMATIC (QUALIFICATION)
+ 24/27:	UNKNOWN
* 26/27:	CAUSAL (LIKELY)
+ 26/28:	CAUSAL (INDIRECT)
+ 26/29:	? CAUSAL (LIKELY)
* 27/28:	THEMATIC (? REPETITION; ? QUALIFICATION)
+ 27/29:	CAUSAL (CAUSE-EFFECT)
* 28/29:	CAUSAL (CAUSE-EFFECT)

APPENDIX 5.7: COMPUTER PROGRAM FOR CLUSTER ANALYSIS OF CLAUSE RECALL

This program is written for a BBC Model B microcomputer (OS 1.2, BASIC I) and an Epson FX80 printer. Its presentation here is for readability, and there are many ways in which it can be made more efficient or more compact, for example by using byte arrays and more efficient use of . The principles on which it is based are explained in Chapter 6, and explanatory comments are spread throughout the listing. Data is entered from the keyboard as two digit numbers between 00 and 99, corresponding to values of the contingency coefficient of between .00 and .99, and is ordered by reading across the data matrix (see Appendix 5.5 or 5.9).

```
 10 REM  Clause cluster analysis - Version 6
 20
 30 REM  This analysis uses a decreasing clustering criterion, the
 40 REM  contingency coefficient (C/C) on the recall of clause pairs.
 50 REM  It involves calculating the mean C/C between a clause and a
 60 REM  cluster of clauses, within a cluster and between two clusters.
 70 REM  Each clause is assumed to belong to a single cluster, decided
 80 REM  by the mean C/C between the clause and the rest of the cluster
 90 REM  or by the mean C/C of the cluster were the clause added to it.
100
110 REM  val%   'simplified' contingency coefficients for clauses
120 REM  m%     serial number of cluster to which each clause belongs
130 REM  clus%  serial numbers of clauses in each cluster
140 REM  mem%   number of clauses in each cluster
150 REM  mean   mean contingency coefficient within each cluster
160
170 MODE7: PROCstart
180 DIM val%(30,30), m%(30), clus%(15,30), mem%(15), mean(15)
190 next% = 1
200
210 REM  Main program
220 PROCinput
230 FOR G% = 1 TO 2
240   FOR H% = 70 TO 10 STEP -1
250     check% = FALSE
260     FOR I% = 1 TO C% - 1
270       FOR J% = I% TO C%
280         IF val%(I%,J%) >= H% THEN PROCcompare(I%,J%)
290       NEXT
300     NEXT
310     IF check% THEN PROCprint
320   NEXT
330   PROCprinter_on: CLS: PROCprinter_off
340   PROCclear
350 NEXT
360 PROCend
370
380 DEF PROCstart
390 *FX14,6
400 @% = 10: VDU 12,23;8202;0;0;0;
410 ENDPROC
420
430 DEF PROCend
440 PROCprinter_off
450 *FX13,6
460 CLS: @% = 10
470 END
480 ENDPROC
```

```
490
500 DEF PROCinput
510 REM  Input number of clauses and contingency coefficients.
520 REPEAT
530   CLS: *FX15,1
540   INPUT TAB(0,8) "Enter number of clauses: " C%
550   IF C% < 2 OR C  IF C% < 2   560 UNTIL C% > 1 AND C% < 31
570 PROCtone(5): PROCpause(50): @% = 4
580 FOR I% = 2 TO C%
590   CLS: PRINT TAB(0,6) "LINE "; I%
600   PRINT ' "Enter coefficients (00 to 99):"
610   PRINT ' "Press 'D' to reenter number"
620   PRINT ' "Press 'H' to reenter line" '
630   FOR J% = 1 TO I% - 1
640     FOR K% = 1 TO 2
650       *FX15,1
660       REPEAT A$ = GET$: UNTIL (A$ >= "0" AND A$ <= "9") OR A$ = "H"
          OR A$ = "D"
670       IF A$ = "D" THEN PROCdo_D
680       IF A$ = "H" THEN I% = I% - 1: VDU7: GOTO 790
690       IF K% = 1 THEN B$ = A$
700       PRINT A$;: IF K% = 2 THEN PRINT "  ";
710     NEXT
720     L% = 10 * VAL(B$) + VAL(A$): val%(J%,I%) = L%
730     PROCpause(30): PROCtone(3)
740   NEXT
750   PROCtone(5)
760   PRINT ''' "Press SPACE to continue" '' "Press 'H' to reenter line"
770   REPEAT A$ = GET$: UNTIL A$ = " " OR A$ = "H"
780   IF A$ = "H" THEN I% = I% - 1: VDU7
790   IF I% < 1 THEN I% = 1
800 NEXT I%
810 CLS: PRINT TAB(7,8) "Calculations in progress"
820 ENDPROC
830
840 DEF PROCdo_D
850 A$ = ""
860 IF K% = 2 THEN VDU 127
870 IF K% = 1 AND J% > 1 THEN J% = J% - 1: VDU 127,127,127,127
880 VDU7: K% = 0
890 ENDPROC
900
910 DEF PROCpause(Z%)
920 ZZ% = TIME
930 REPEAT UNTIL TIME - ZZ% = Z%
940 ENDPROC
950
960 DEF PROCtone(T%)
970 SOUND 1,-(2 * T% + 2),200,T%
980 SOUND 2,-(2 * T% + 2),200,T%
990 ENDPROC
1000
1010 DEF PROCcompare(A%,B%)
1020 REM  If a contingency coefficient is greater than the current criterion,
1030 REM  a check is made to see if either or both of the clauses is already
1040 REM  a member of a cluster: three courses of action are then open.
1050 CLS: PRINT TAB(7,8) "Calculations in progress"
1060 PROCtone(2)
1070 IF m%(A%) = 0 AND m%(B%) = 0 THEN PROCcreate
1080 IF m%(A%) > 0 AND m%(B%) = 0 THEN PROCtry1(A%,B%)
1090 IF m%(A%) = 0 AND m%(B%) > 0 THEN PROCtry1(B%,A%)
```

```
1100 IF m%(A%) > 0 AND m%(B%) > 0 THEN IF m%(A%) <> m%(B%) THEN PROCtry2
1110 ENDPROC
1120
1130 DEF PROCcreate
1140 REM  If neither clause is a member of a cluster, they
1150 REM  are combined to form a new cluster.
1160 m%(A%) = next%: m%(B%) = next%
1170 clus%(next%,1) = A%: clus%(next%,2) = B%: mem%(next%) = 2
1180 mean(next%) = val%(A%,B%)
1190 next% = next% + 1: check% = TRUE
1200 ENDPROC
1210
1220 DEF PROCtry1(A%,B%)
1230 REM  If only one clause is already a member of a cluster,
1240 REM  the criterion for adding the other is calculated.
1250 LOCAL I%
1260 NA% = m%(A%): noA% = mem%(NA%): sum = 0
1270 FOR I% = 1 TO noA%
1280   a% = clus%(NA%,I%): b% = B%
1290   IF a% > b% THEN c% = a%: a% = b%: b% = c%
1300   sum = sum + val%(a%,b%)
1310 NEXT
1320 IF G% = 1 THEN ave = sum / noA%
1330 IF G% = 2 THEN sum = sum + mean(NA%) * noA% * (noA% - 1) / 2:
     ave = sum * 2 / (noA% * (noA% + 1))
1340 IF ave >= H% THEN PROCadd(A%,B%)
1350 ENDPROC
1360
1370 DEF PROCadd(A%,B%)
1380 REM  If the single clause can be added to the cluster, this is done.
1390 m%(B%) = NA%
1400 mem%(NA%) = mem%(NA%) + 1: noA% = mem%(NA%)
1410 clus%(NA%,noA%) = B%
1420 mean(NA%) = ave
1430 check% = TRUE
1440 ENDPROC
1450
1460 DEF PROCtry2
1470 REM  If both clauses are already members of (different) clusters,
1480 REM  the effect on the overall mean contingency coefficient of
1490 REM  combining the two clusters is calculated.
1500 LOCAL I%, J%
1510 NA% = m%(A%): NB% = m%(B%): noA% = mem%(NA%): noB% = mem%(NB%)
1520 ncA% = noA% * (noA% - 1) / 2: ncB% = noB% * (noB% - 1) / 2
1530 nc% = ncA% + ncB% + noA% * noB%
1540 sum = 0
1550 FOR I% = 1 TO noA%
1560   FOR J% = 1 TO noB%
1570     a% = clus%(NA%,I%): b% = clus%(NB%,J%)
1580     IF a% > b% THEN c% = a%: a% = b%: b% = c%
1590     sum = sum + val%(a%,b%)
1600   NEXT
1610 NEXT
1620 IF G% = 1 THEN ave = sum / (noA% * noB%)
1630 IF G% = 2 THEN sum = sum + mean(NA%) * ncA% + mean(NB%) * ncB%:
     ave = sum / nc%
1640 IF ave >= H% THEN PROCmerge
1650 ENDPROC
1660
1670 DEF PROCmerge
1680 REM  If necessary, the two clusters are combined.
```

```
1690 LOCAL I%
1700 FOR I% = 1 TO noB%
1710   m%(clus%(NB%,I%)) = m%(A%)
1720   clus%(NA%,noA% + I%) = clus%(NB%,I%): clus%(NB%,I%) = 0
1730 NEXT
1740 mean(NA%) = ave: mean(NB%) = 0
1750 mem%(NA%) = noA% + noB%: mem%(NB%) = 0
1760 check% = TRUE
1770 ENDPROC
1780
1790 DEF PROCprint
1800 REM  The results are printed out, clusters with their members first,
1810 REM  then any isolated clauses.
1820 PROCprinter_on
1830 VDU27,33,0
1840 PRINT "CLUSTER ANALYSIS TYPE "; G%; " ON CLAUSE RECALL DATA AT
     CRITERION LEVEL "; H%
1850 PRINT "Clusters formed at this level:"
1860 FOR I% = 1 TO 15
1870   IF mem%(I%) > 0 THEN PROCprint_cluster(I%)
1880 NEXT
1890 PRINT "Clauses not in any cluster:";
1900 FOR I% = 1 TO C%
1910   IF m%(I%) = 0 THEN PRINT I%;
1920 NEXT
1930 IF H% = 10 THEN CLS: ELSE PRINT '
1940 PROCprinter_off
1950 ENDPROC
1960
1970 DEF PROCprint_cluster(I%)
1980 PRINT "    Cluster no."; I%; " ";
1990 FOR J% = 1 TO mem%(I%)
2000   PRINT clus%(I%,J%);
2010 NEXT
2020 PRINT
2030 ENDPROC
2040
2050 DEF PROCprinter_on
2060 CLS: PRINT TAB(9,12) "Printing in progress"
2070 *FX3,10
2080 VDU 27,33,0,27,108,5,27,78,6: @% = 3
2090 ENDPROC
2100
2110 DEF PROCprinter_off
2120 VDU 27,33,0,27,108,0,27,78,0
2130 *FX3
2140 ENDPROC
2150
2160 DEF PROCclear
2170 REM  Clears all arrays except val% for second analysis.
2180 CLS: PRINT TAB(7,8) "Calculations in progress"
2190 FOR I% = 1 TO 15
2200   FOR J% = 1 TO 30
2210     clus%(I%,J%) = 0: m%(J%) = 0
2220   NEXT
2230   mem%(I%) = 0: mean(I%) = 0
2240 NEXT
2250 next% = 1
2260 ENDPROC
```

APPENDIX 5.8: EXPERIMENTS I AND II: PASSAGES 1A, 2C AND 3B: QUALITATIVE ANALYSIS OF CLAUSE CLUSTERS

The following clusters of clauses are taken from Tables 6.8-6.10, and include all clusters formed at a SCC criterion level of 0.25, by either method, with occasional reference to clauses added at slightly lower criteria. The comments attempt where possible to describe the basis on which the cluster might have been formed, and therefore extend to the analysis of clause recall contingencies presented in Appendix 5.6.

PASSAGE 1A

As previously noted, most clauses in this passage contain references to the main actor, and about half to the main object. This means there is a good chance that some sort of thematic or even causal relation could be invented for any pairing of clauses taken at random. All reasons suggested for clause clustering must therefore refer to more substantial features.

Clauses 2, 3, 4, 15:

Clauses 3 and 4 represent a possibly thematic coupling, to which 2 is only distantly connected (though causally related to 3). Clause 15 only clusters with this group under the second method, for no discernable reason.

Clauses 5, 11, 25:

Nothing extra can be added to the UNKNOWN verdict on the relation between 5 and 25.

Clauses 9, 12, 13, 14, 15, 16

Of these clauses, 12 and 16 are the most closely related, an association previously called CONSECUTIVE. With the omission of clauses 10 and 11 (arguably inessential), these form a continuous sequence, though the group (minus 14) only barely forms under method one, and 15 is not a member under method two. Of the central four clauses (9, 12, 13, 16) only 12 and 13 can be argued to be causally related; together the group is more like the components of a single activity (a chase sequence), than cause-effect sequences or goal-action-outcome episodes.

Clauses 18, 29

Again, the UNKNOWN comment on this pairing must stand.

Clauses 19, 23, 26

These three clauses do seem interrelated on causal grounds: 19/23 and 23/26 were both labeled CAUSAL (LIKELY) before. Another interpretation would make them components of a highly predictable action sequence (shooting, killing, retrieving), which, although it might be described in (essentially abstract) goal-oriented terms, could equally be argued to represent a (script-organised) piece of general knowledge.

Clauses 21, 27:

This pairing was described before as CONSECUTIVE, to which nothing further can be added. Distant relations with 8 (first method) seem unexplained, as do relations with 18 and 29 (second method).

Clauses 28, 30

A simple CAUSAL interpretation probably suffices for this pairing.

PASSAGE 2C

The most noticeable thing about the clustering results on this passage is the dearth of clusters, but the two methods of analysis are again in good agreement.

Clauses 5, 29, 30

The relation between 29 and 30 was described before as THEMATIC: the two clauses represent components of the same overall action with no causal or goal-oriented factors visibly present. There is no obvious reason for associating clause 5 with them, however.

Clauses 6, 18, 19, 23

The pairing of clauses 6 and 18 was described as THEMATIC and of 18 and 19 as CAUSAL. These separate linkings may have helped grouped the three together. Clustering these with 23 is a product of the second clustering method only and does not seem to have any obvious rationale.

Clauses 11, 13, 14, 26

While 13/14 was previously described as THEMATIC, the association of clause 11 with either of them could not be explained (though it is obviously close to them in the passage). Similarly, no convincing reason suggests itself for the association of clause 26 with the other three.

Clauses 20, 21, 25

The association of 20/21 has been labelled CAUSAL though this is rather weak and a THEMATIC interpretation is also possible. Despite being quite close in the passage, there is no special reason why 25 should be associated with the others.

PASSAGE 3B

The large amount of clustering within this passage, and the extent to which these analyses manage to 'retrieve' a majority of its subdivisions are the most remarkable features about this passage. One curious aspect of the composition of the clusters for this passage is the way an otherwise coherent set of clauses has had an extra clause from the beginning of the passage unexpectedly added to it; this occurred three times: (3, 13,14,15,16,17), (6, 18, 1, 20), (5, 21, 22, 23, 24).

Clauses 2, 7, 8, 25

Of the six possible clause pairings present in the cluster, four were large enough to be discussed earlier. Of the four, three were judged UNKNOWN and one, 7/8, was regarded as THEMATIC. There is no reason to question the reality of the 7/8 pairing, but the all other aspects of this group suggest a spurious formation.

Clauses 3, 13, 14, 15, 16, 17

Except for Clause 3, these obviously constitute a consecutive set. The pairings 3/17 and 14/16 were tentatively identified as THEMATIC and 14/15 and 15/16 as CAUSAL. With the exception of clause 3, a complete subsection of the passage is included here: a single, five-clause sentence about what the builders did to the walls and why. It is therefore full of causal and noncausal relations. The association of 3 with the others may be chance or because subjects considered them all to refer to the way rooms were decorated.

Clauses 4, 30

There seems little cause for the distant association of these two clauses, which is best considered spurious.

Clauses 5, 21, 22, 23, 24

This cluster consists of four consecutive clauses from the five in the subdivision concerning the choice of the site for the house. The linking of 5 with the other clauses looks like another chance effect. Of the six possible pairings of clauses 21-24, five were SCC's of 0.3 or more of which two were perhaps THEMATIC, one CAUSAL and two INDIRECT CAUSAL, ie weakly causal. Though causal relations could be read into the subdivision as a whole, the main principle of cohesion seems more (noncausal) thematic, centring on the site of the house.

Clauses 6, 18, 19, 20, 26, 27, 28, 29

This large cluster really decomposes into two. Clauses 18, 19 and 20 summarise the complete section on the special heating provision for the house, among which simple thematic relations (all discussing the central heating) predominate over causal ones (low temperature causes no fire hazard). The association of 6 with these three is interesting: 6/19 and 6/20 were previously described as possibly CAUSAL, and UNKNOWN respectively, but taking 18, 19 and 20 together, the association with 6 seems quite likely to be mediated by the idea of central heating, which both might be claimed to be describing: this is noncausal thematic again. Clauses 26, 27, 28 and 29 form another complete sequence, about the gardeners and what they did to the garden. All six pairings of these clauses featured in the contingency analyses, five being described as CAUSAL, one as plain THEMATIC. The strong presence of goals, actions and outcomes makes noncausal thematic interpretation difficult. In stark contrast with the observations so far, no plausible reason suggests itself for the clustering of the two main groups of clauses here.

Clauses 9, 11

Despite their proximity, there is little apparent relation between these two clauses, though some THEMATIC connection, mediated by the image or concept of cold and ice might be suggested.

PENDIX 5.9: EXPERIMENT V: RECALL CONTINGENCIES

ssage F: recall (1) and omission (0) of clauses

jects	Clauses 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	0	1	0	1	0	0	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0	1	0	1	1	1	1	1	0
2	1	1	0	1	0	0	0	1	1	0	1	0	0	1	0	0	1	0	1	0	0	1	1	1	1	0	0	1	1	1
3	1	1	0	1	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	0	0	1	1	1	0	0	1	1	1
4	1	1	0	1	1	0	1	1	1	1	1	0	0	1	0	1	1	1	0	1	1	1	1	1	0	1	0	1	1	1
5	1	1	0	0	0	0	0	1	1	1	0	0	1	0	0	0	0	0	1	1	0	1	1	0	1	1	0	1	1	1
6	1	1	0	0	1	0	0	0	1	1	1	1	1	1	0	0	1	1	0	1	1	0	1	1	1	0	0	1	1	1
7	1	1	0	0	1	0	0	1	1	1	1	1	1	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1
8	0	0	0	1	1	0	0	1	1	0	1	0	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
9	1	1	0	0	1	0	0	1	1	1	1	1	1	1	0	0	1	0	0	1	0	1	1	0	1	1	1	1	1	1
10	1	1	0	0	1	0	0	1	1	1	1	1	0	0	0	0	1	0	0	0	1	1	1	1	0	0	0	1	1	0
11	1	1	0	1	1	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
12	1	1	0	0	1	0	1	0	1	1	1	1	0	1	0	1	1	1	0	1	0	1	1	1	1	0	0	1	1	1
13	1	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0	1	0	1
14	1	1	0	0	1	0	0	1	1	1	0	1	1	0	0	0	1	0	0	1	0	1	1	1	1	0	0	1	1	0
15	1	1	0	1	0	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1
16	1	1	0	1	1	0	0	1	1	1	1	1	0	1	0	1	0	0	0	1	0	1	1	1	1	0	0	1	1	0
17	1	1	0	1	1	0	0	1	1	1	0	1	0	1	0	0	1	0	0	0	0	1	1	1	1	0	0	1	1	1
18	1	1	0	0	1	0	0	1	1	0	0	0	1	1	0	1	1	1	0	1	0	1	1	1	1	0	0	1	1	1
19	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	1	1	1	1	1	1	1	1	0	1	1	1
20	1	0	0	0	1	0	0	1	1	0	1	0	0	0	0	0	0	0	1	0	0	1	1	1	1	0	0	1	1	1
21	1	0	1	1	1	0	0	1	1	1	1	1	0	0	0	0	0	0	1	1	0	1	1	1	1	0	0	1	1	1
22	1	0	0	1	1	0	0	1	1	0	0	1	1	1	0	1	1	0	0	1	0	1	1	1	1	1	1	1	1	1
23	1	1	0	0	1	0	1	1	1	1	1	0	1	1	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1
24	1	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	1	1	0
25	1	1	0	1	1	0	0	1	1	0	0	0	1	0	0	0	1	0	0	1	0	1	1	1	1	1	0	1	1	1
26	1	1	0	1	1	0	0	0	1	0	0	0	1	1	1	0	0	0	1	1	1	1	1	1	1	0	1	1	1	1
27	0	1	0	1	1	0	0	1	1	1	1	1	1	0	0	0	1	0	1	1	1	1	1	0	1	1	1	1	1	0
28	1	1	0	1	0	0	0	1	1	0	1	0	0	1	1	1	0	0	0	1	0	1	1	1	1	1	0	1	1	1
29	1	1	0	1	1	0	0	0	1	0	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
30	1	1	0	0	1	0	0	0	1	1	1	1	1	1	0	1	1	0	0	1	0	1	1	1	1	0	1	1	1	1
31	1	1	0	1	0	0	0	1	1	0	1	1	1	0	1	0	1	0	0	1	0	1	1	1	1	0	0	1	1	1
32	1	1	0	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	1	1	1	1
33	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	1	1	1	1	1	1	1	0	0	1	1	1
34	1	1	0	1	1	0	1	0	0	0	1	0	0	1	0	1	0	0	1	1	0	1	1	0	1	0	1	1	1	1
35	1	1	0	0	0	0	0	1	1	0	0	1	1	1	0	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1
36	1	1	0	0	1	0	0	1	1	1	1	0	0	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1
37	1	1	0	1	1	0	0	1	1	1	0	1	1	1	0	1	1	0	0	1	0	1	1	1	1	0	0	1	1	1
38	1	1	0	1	0	0	0	1	1	1	0	1	1	1	0	0	1	0	1	1	0	1	1	1	0	0	0	1	1	1
39	0	1	0	1	0	0	1	1	1	0	0	0	1	1	0	0	0	0	0	0	0	1	1	1	1	0	0	1	1	1
40	1	1	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1
41	1	1	0	1	1	0	0	1	1	1	1	1	1	1	0	0	1	0	1	1	1	1	1	1	1	1	0	1	1	1

jects	Clauses 31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
1	1	0	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	1	1	1	1	0	1	0	1
2	1	0	0	1	1	1	1	0	1	0	0	0	0	1	1	0	0	1	1	1	1	1	0	1	1
3	1	0	1	1	1	1	0	0	1	0	0	0	1	1	1	0	0	1	1	1	1	1	0	0	0
4	1	1	1	1	1	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1	1	1	0	0	0
5	1	0	1	1	1	0	0	0	1	1	0	1	1	1	0	0	0	1	1	1	1	1	1	0	1
6	1	0	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	1	1	1	1	1	0	0	0
7	0	1	1	1	1	1	1	0	1	1	0	0	1	1	0	0	0	1	1	1	1	0	1	0	1
8	1	1	1	1	1	1	0	0	1	1	0	0	1	1	1	0	1	1	1	1	1	0	1	0	1
9	1	0	1	1	1	1	0	0	1	1	0	1	0	1	0	0	0	1	1	1	1	1	0	0	1
10	1	1	1	1	0	0	0	0	0	0	0	1	1	1	0	1	0	1	1	1	1	1	0	0	0
11	1	0	1	1	1	1	1	0	1	1	0	0	1	1	1	1	0	1	1	1	1	0	0	0	1
12	1	0	1	1	1	1	0	0	1	0	0	0	1	0	1	0	0	1	1	1	1	1	0	0	1
13	0	0	1	1	1	0	1	1	1	1	0	0	0	1	0	0	0	1	1	1	1	1	0	0	1
14	1	0	1	1	1	1	1	1	1	0	0	0	1	1	1	0	0	1	1	1	1	1	0	0	1
15	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0	1	1	1	1	1	1	0	1
16	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	0	1	1
17	1	0	1	1	1	1	0	0	1	0	0	1	0	1	0	0	0	1	1	1	1	0	0	0	0
18	1	1	1	1	1	1	0	0	1	0	0	0	0	0	1	0	0	1	1	1	1	1	0	0	0
19	1	1	1	1	1	1	0	0	0	1	0	0	0	1	1	0	1	1	1	1	1	0	1	0	1
20	1	0	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	1	1	1	1	1	0	0	1
21	1	1	1	1	1	1	0	0	1	1	0	0	1	0	1	0	0	1	1	1	1	1	1	1	0
22	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0
23	0	0	1	1	1	1	1	0	1	1	0	0	0	0	1	0	0	1	1	1	1	1	1	0	1
24	1	1	1	1	1	1	0	0	0	1	0	1	1	1	0	0	0	1	1	1	1	1	0	0	1
25	1	1	1	1	1	1	1	0	1	1	0	1	0	1	1	0	0	1	1	1	1	0	0	1	0
26	1	1	1	1	1	0	0	0	1	1	0	0	1	1	0	0	0	1	1	1	1	1	0	0	1
27	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	0	1	1	1	1	1	1	0	0	1
28	1	0	1	1	1	1	1	0	1	1	0	0	1	1	0	0	0	1	1	1	1	0	0	0	1
29	0	1	1	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	0	0	1
30	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1	0	1	1	1	1	1	1	0	0	1
31	1	0	1	1	1	1	1	1	0	1	0	0	0	1	1	0	1	1	1	1	1	0	0	1	1
32	1	0	1	1	1	0	0	0	1	1	0	0	0	1	1	0	0	1	1	1	1	0	0	0	1
33	1	0	1	1	1	0	0	0	1	1	0	0	1	1	1	0	0	1	1	1	1	1	0	0	1
34	0	0	1	1	1	0	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0
35	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	0	1	1	1	1	0	0	0	0
36	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0	0	1	1	1	1	1	0	0	1
37	1	1	1	1	1	0	0	0	0	1	0	0	1	1	0	0	0	1	1	1	1	0	0	0	1
38	1	1	1	1	1	1	1	0	1	0	0	1	1	1	1	0	1	1	1	1	1	0	0	0	1
39	1	0	1	1	1	1	0	0	1	0	0	0	1	1	0	0	0	1	1	1	1	0	0	1	1
40	1	1	1	1	1	0	1	0	0	1	0	0	1	1	0	0	0	1	1	1	1	0	0	0	1
41	1	1	1	1	1	0	1	1	1	1	0	1	0	1	1	1	0	1	1	1	1	0	0	0	0

ssage F: contingency coefficients on recall of pairs of clauses

1														
1E-3	2													
1E-1	1.8E-1	3												
9E-1	6.4E-2	2.7E-2	4											
0E-1	1.2E-1	9.4E-2	7.4E-2	5										
1E-1	1.8E-1	4.4E-1	2.7E-2	9.4E-2	6									
2E-1	1.1E-1	1.1E-1	1.5E-1	4.2E-2	1.1E-1	7								
0E-2	7.0E-2	1.4E-1	5.3E-2	1.8E-1	1.4E-1	5.7E-3	8							
2E-1	8.8E-2	3.1E-1	7.5E-2	3.2E-3	3.1E-1	1.7E-2	4.8E-2	9						
0E-2	8.4E-2	3.6E-2	1.4E-2	1.8E-1	3.6E-2	1.2E-1	3.1E-2	1.6E-1	10					
1E-2	1.4E-2	6.2E-2	1.2E-2	4.0E-2	6.2E-2	1.7E-1	1.0E-1	3.3E-2	2.5E-1	11				
6E-2	6.4E-2	2.7E-2	4.5E-2	4.1E-2	2.7E-2	2.8E-2	5.3E-2	1.5E-1	5.1E-1	1.2E-1	12			
2E-2	4.6E-2	1.9E-2	9.6E-2	1.3E-2	1.9E-2	6.5E-2	5.6E-2	1.4E-1	4.8E-2	3.2E-1	2.0E-1	13		
9E-2	2.7E-2	8.2E-2	2.1E-1	2.3E-2	8.2E-2	2.5E-1	2.0E-1	9.3E-3	1.3E-1	1.2E-1	1.0E-1	3.6E-2	14	
0E-2	7.0E-2	1.4E-1	1.8E-1	1.2E-1	1.4E-1	5.7E-3	5.2E-2	4.8E-2	3.1E-2	1.0E-1	5.3E-2	5.6E-2	5.5E-2	15

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
8E-2	2.7E-2	1.2E-2	3.8E-2	1.3E-1	1.2E-2	3.9E-2	1.6E-1	9.6E-2	8.6E-3	1.6E-1	3.8E-2	2.1E-1	4.5E-1	1.6E-1	16
1E-2	1.4E-2	6.2E-2	1.2E-1	4.0E-2	6.2E-2	4.5E-2	3.9E-2	3.3E-2	2.5E-1	1.5E-1	4.0E-1	8.3E-2	1.2E-1	3.9E-2	17
8E-2	8.9E-2	1.2E-1	2.3E-2	6.5E-2	1.2E-1	2.5E-1	1.8E-1	3.1E-2	7.8E-2	1.4E-1	2.3E-2	1.2E-1	2.2E-1	2.2E-2	18
4E-2	1.4E-1	3.9E-3	2.1E-1	1.5E-1	3.9E-3	1.3E-2	1.1E-2	1.1E-1	3.0E-2	2.2E-1	2.1E-2	1.2E-1	1.5E-2	1.2E-1	19
0E-2	4.9E-2	1.6E-1	1.7E-3	5.9E-3	1.6E-1	3.0E-2	9.6E-2	6.6E-2	1.6E-1	8.8E-2	1.4E-1	1.2E-1	1.4E-1	9.6E-2	20
4E-1	6.4E-2	2.7E-2	5.5E-2	7.4E-2	2.7E-2	2.8E-2	7.8E-2	7.5E-2	2.1E-1	3.8E-1	5.5E-2	3.6E-3	1.2E-1	2.1E-1	21
0E-2	3.1E-3	2.1E-1	2.6E-2	9.1E-2	2.1E-1	1.2E-1	4.0E-2	1.2E-1	1.0E-2	4.1E-2	2.6E-2	4.2E-2	7.9E-2	4.0E-2	22
0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	23
1E-1	4.9E-2	1.6E-1	1.7E-3	1.6E-1	1.6E-1	1.9E-1	8.7E-2	6.6E-2	1.2E-1	6.0E-2	1.7E-3	1.9E-2	1.7E-2	8.7E-2	24
0E-2	3.1E-3	2.1E-1	2.6E-2	9.1E-2	2.1E-1	7.5E-2	4.0E-2	1.2E-1	1.8E-1	4.1E-2	2.6E-2	4.2E-2	7.9E-2	4.0E-2	25
2E-1	4.6E-2	1.9E-2	9.6E-2	1.3E-2	1.9E-2	5.3E-2	7.5E-2	8.6E-2	5.3E-2	1.3E-1	3.6E-3	1.4E-1	1.5E-1	5.6E-2	26
7E-1	5.1E-2	4.4E-2	2.9E-2	1.4E-1	4.4E-2	2.5E-2	2.5E-1	5.4E-2	6.7E-2	2.8E-2	2.9E-2	2.1E-1	1.7E-1	8.2E-3	27
0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	28
1E-1	1.8E-1	4.4E-1	2.7E-2	9.4E-2	4.4E-1	1.1E-1	1.4E-1	3.1E-1	3.6E-2	6.2E-2	2.7E-2	1.9E-2	8.2E-2	1.4E-1	29
8E-1	7.0E-2	1.4E-1	5.3E-2	3.1E-2	1.4E-1	5.7E-3	5.2E-2	4.8E-2	1.6E-1	1.0E-1	1.8E-1	5.6E-2	9.1E-2	5.2E-2	30

16														
5E-2	17													
2E-1	2.6E-1	18												
3E-2	1.7E-2	4.9E-2	19											
0E-1	8.8E-2	1.2E-1	7.9E-2	20										
2E-2	2.9E-1	2.6E-1	3.5E-1	1.4E-1	21									
8E-2	4.1E-2	1.5E-1	7.4E-2	2.0E-2	2.6E-2	22								
0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	23							
9E-2	6.0E-2	5.7E-2	1.9E-1	7.4E-2	1.7E-3	2.0E-2	0.0E0	24						
8E-2	1.3E-1	5.8E-2	7.4E-2	2.0E-2	1.4E-1	3.0E-2	0.0E0	2.0E-2	25					
1E-1	2.2E-2	1.5E-3	1.2E-1	2.8E-1	2.9E-1	4.2E-2	0.0E0	1.2E-1	4.2E-2	26				
6E-1	8.1E-2	5.4E-2	8.2E-2	9.9E-2	1.3E-1	6.2E-3	0.0E0	1.8E-1	6.2E-3	3.7E-1	27			
0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	28		
2E-2	6.2E-2	1.2E-1	3.9E-3	1.6E-1	2.7E-2	2.1E-1	0.0E0	1.6E-1	2.1E-1	1.9E-2	4.4E-2	0.0E0	29	
3E-2	1.0E-1	2.2E-2	1.1E-2	8.7E-2	2.1E-1	4.0E-2	0.0E0	8.7E-2	4.0E-2	5.6E-2	8.2E-3	0.0E0	1.4E-1	30

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
.0E-2	4.9E-2	1.6E-1	1.7E-3	1.5E-1	1.6E-1	3.0E-2	8.7E-2	6.6E-2	1.6E-1	6.0E-2	1.4E-1	1.9E-2	1.7E-2	9.6E-2	31
.8E-2	2.7E-2	1.2E-2	1.4E-1	1.3E-1	1.2E-2	7.9E-2	3.3E-2	9.6E-2	9.1E-2	5.0E-2	3.8E-2	8.3E-2	6.6E-2	3.3E-2	32
.2E-1	8.8E-2	3.1E-1	7.5E-2	3.2E-3	3.1E-1	1.7E-2	4.8E-2	2.1E-1	1.6E-1	3.3E-2	7.5E-2	8.6E-2	9.3E-3	4.8E-2	33
.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	34
.2E-1	8.8E-2	3.1E-1	7.5E-2	3.2E-3	3.1E-1	1.7E-2	4.8E-2	2.1E-1	6.5E-2	3.3E-2	7.5E-2	8.6E-2	9.3E-3	4.8E-2	35
.1E-1	2.7E-2	8.2E-2	6.8E-3	2.3E-2	8.2E-2	1.2E-1	9.1E-2	2.4E-1	1.3E-1	2.3E-1	1.0E-1	3.6E-2	1.9E-1	5.5E-2	36
.2E-2	1.9E-1	1.9E-2	3.6E-3	1.0E-1	1.9E-2	5.3E-2	5.6E-2	8.6E-2	4.8E-2	1.9E-1	3.6E-3	4.0E-2	3.6E-2	7.5E-2	37
.1E-2	1.4E-2	6.2E-2	1.2E-2	4.0E-2	6.2E-2	4.5E-2	3.9E-2	3.3E-2	6.1E-2	1.8E-1	1.2E-2	8.3E-2	1.4E-3	3.9E-2	38
.8E-2	9.8E-2	1.2E-1	1.0E-1	6.5E-2	1.2E-1	3.8E-2	2.2E-2	3.1E-2	7.8E-2	4.8E-3	2.2E-1	1.2E-1	4.9E-2	1.8E-1	39
.1E-2	1.4E-2	6.2E-2	1.2E-2	4.0E-2	6.2E-2	2.0E-1	3.9E-2	3.3E-2	6.1E-2	1.5E-1	9.4E-2	8.3E-2	1.2E-1	1.0E-1	40
.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	41
.0E-2	6.9E-2	3.6E-2	1.4E-2	4.7E-2	3.6E-2	1.2E-1	3.1E-2	6.5E-2	2.7E-1	4.6E-2	1.1E-1	4.8E-2	2.3E-2	3.1E-2	42
.1E-2	1.4E-2	6.2E-2	1.2E-2	4.0E-2	6.2E-2	4.5E-2	2.3E-1	3.3E-2	1.5E-1	4.3E-2	1.2E-1	1.3E-1	1.2E-1	1.0E-1	43
.1E-3	2.5E-2	1.8E-1	2.1E-1	1.2E-1	1.8E-1	7.2E-2	7.0E-2	8.8E-2	6.9E-2	1.4E-2	6.4E-2	4.6E-2	2.7E-2	7.0E-2	44
.6E-2	6.4E-2	2.7E-2	4.5E-2	4.1E-2	2.7E-2	2.8E-2	5.3E-2	7.5E-2	1.4E-2	1.2E-1	4.5E-2	3.6E-3	6.8E-3	7.8E-2	45

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
.9E-2	8.8E-2	5.7E-2	7.9E-2	7.4E-2	1.7E-3	2.0E-2	0.0E0	7.4E-2	2.0E-2	1.2E-1	3.1E-1	0.0E0	1.6E-1	8.7E-2	31
.6E-1	1.6E-1	2.6E-2	2.6E-1	1.7E-1	4.2E-1	2.2E-1	0.0E0	3.9E-2	2.6E-1	2.1E-1	5.6E-2	0.0E0	1.2E-2	3.3E-2	32
.6E-2	3.3E-2	3.1E-2	1.1E-1	6.6E-2	7.5E-2	1.2E-1	0.0E0	6.6E-2	1.2E-1	8.6E-2	5.4E-2	0.0E0	3.1E-1	4.8E-2	33
.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	34
.6E-2	3.3E-2	3.1E-2	1.2E-1	6.6E-2	7.5E-2	1.2E-1	0.0E0	6.6E-2	1.2E-1	8.6E-2	5.4E-2	0.0E0	3.1E-1	4.8E-2	35
.6E-2	1.2E-1	2.2E-1	1.5E-2	1.7E-2	6.8E-3	7.9E-2	0.0E0	1.7E-2	7.9E-2	3.6E-2	5.4E-2	0.0E0	8.2E-2	5.5E-2	36
.6E-2	2.2E-2	1.5E-3	2.8E-2	1.2E-1	3.6E-3	4.2E-2	0.0E0	1.9E-2	4.2E-2	1.4E-1	8.7E-3	0.0E0	1.9E-2	5.6E-2	37
.0E-2	4.3E-2	2.5E-1	1.7E-2	6.0E-2	1.2E-1	2.1E-1	0.0E0	6.0E-2	4.1E-2	2.2E-2	2.8E-2	0.0E0	6.2E-2	1.8E-1	38
.7E-2	2.6E-1	9.5E-3	7.3E-2	5.7E-2	1.5E-1	5.8E-2	0.0E0	1.2E-1	3.4E-1	1.5E-3	5.4E-2	0.0E0	1.2E-1	2.2E-2	39
.0E-2	2.8E-1	1.3E-1	2.2E-1	2.3E-1	2.0E-1	4.1E-2	0.0E0	6.0E-2	2.1E-1	3.2E-1	2.4E-1	0.0E0	6.2E-2	3.9E-2	40
.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	41
.6E-3	6.1E-2	4.8E-2	3.0E-2	2.2E-2	8.8E-2	1.8E-1	0.0E0	1.6E-1	1.6E-1	1.5E-1	3.7E-2	0.0E0	3.6E-2	2.3E-1	42
.3E-1	4.3E-2	4.8E-3	1.2E-1	2.3E-1	2.0E-1	4.1E-2	0.0E0	6.0E-2	1.3E-1	2.2E-2	2.8E-2	0.0E0	6.2E-2	1.0E-1	43
.7E-2	1.4E-1	9.8E-2	9.1E-3	4.9E-2	8.6E-2	3.1E-3	0.0E0	4.9E-2	3.1E-3	4.6E-2	5.1E-2	0.0E0	1.8E-1	7.0E-2	44
.8E-2	1.2E-2	2.3E-2	1.2E-1	1.4E-1	4.5E-2	2.6E-2	0.0E0	1.7E-3	1.4E-1	1.0E-1	2.9E-2	0.0E0	2.7E-2	7.8E-2	45

31														
.9E-2	32													
.6E-2	9.6E-2	33												
.0E0	0.0E0	0.0E0	34											
.6E-2	9.6E-2	2.1E-1	0.0E0	35										
.4E-1	4.4E-2	9.3E-3	0.0E0	2.4E-1	36									
.9E-2	1.6E-2	8.6E-2	0.0E0	1.4E-1	1.8E-1	37								
.0E-2	5.5E-2	3.3E-2	0.0E0	3.3E-2	1.2E-1	4.1E-1	38							
.7E-2	2.2E-1	3.1E-2	0.0E0	3.0E-1	1.8E-1	1.2E-1	4.8E-3	39						
.0E-2	5.5E-2	2.1E-1	0.0E0	2.1E-1	1.2E-1	8.3E-2	4.3E-2	4.8E-3	40					
0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	41				
2E-1	3.0E-1	6.5E-2	0.0E0	6.5E-2	8.9E-2	5.3E-2	1.5E-1	4.8E-2	4.6E-2	0.0E0	42			
0E-2	1.6E-1	3.3E-2	0.0E0	3.3E-2	1.4E-3	2.2E-2	4.3E-2	4.8E-3	7.0E-2	0.0E0	6.1E-2	43		
9E-2	2.7E-2	8.8E-2	0.0E0	8.8E-2	1.4E-1	4.6E-2	1.4E-2	8.9E-2	1.4E-2	0.0E0	6.9E-2	1.4E-2	44	
4E-1	3.8E-2	7.5E-2	0.0E0	1.5E-1	2.1E-1	2.0E-1	1.2E-2	2.6E-1	1.2E-2	0.0E0	1.4E-2	1.2E-2	2.3E-1	45

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
.0E-2	7.0E-2	1.4E-1	5.3E-2	3.1E-2	1.4E-1	5.7E-3	2.2E-1	4.8E-2	3.1E-2	1.0E-1	5.3E-2	5.6E-2	5.5E-2	5.2E-2	46
.5E-1	8.9E-2	1.2E-1	2.2E-1	6.5E-2	1.2E-1	3.8E-2	1.8E-1	3.1E-2	4.8E-2	1.4E-1	2.3E-2	1.5E-3	4.9E-2	2.2E-2	47
.1E-1	1.8E-1	4.4E-1	2.7E-2	9.4E-2	4.4E-1	1.1E-1	1.4E-1	3.1E-1	3.6E-2	6.2E-2	2.7E-2	1.9E-2	8.2E-2	1.4E-1	48
.1E-1	1.8E-1	4.4E-1	2.7E-2	9.4E-2	4.4E-1	1.1E-1	1.4E-1	3.1E-1	3.6E-2	6.2E-2	2.7E-2	1.9E-2	8.2E-2	1.4E-1	49
.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	50
.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	51
.4E-1	6.4E-2	2.7E-2	3.4E-1	1.5E-1	2.7E-2	2.8E-2	1.8E-1	7.5E-2	8.8E-2	2.2E-1	1.5E-1	2.8E-1	1.2E-1	7.8E-2	52
.5E-1	9.8E-2	1.2E-1	2.3E-2	7.8E-2	1.2E-1	2.5E-1	1.4E-1	3.1E-2	2.0E-1	1.4E-1	2.3E-2	1.5E-3	4.9E-2	2.2E-2	53
.0E-2	4.9E-2	1.6E-1	2.7E-1	1.6E-1	1.6E-1	3.0E-2	9.6E-2	6.6E-2	1.6E-1	6.0E-2	1.7E-3	1.9E-2	1.4E-1	8.7E-2	54
.2E-1	6.0E-3	7.2E-2	5.2E-2	1.8E-1	7.2E-2	1.7E-2	6.4E-2	2.1E-2	2.0E-2	8.0E-2	5.2E-2	2.5E-2	3.4E-2	2.2E-1	55

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
.3E-2	3.9E-2	1.8E-1	1.2E-1	8.7E-2	2.1E-1	4.0E-2	0.0E0	8.7E-2	4.0E-2	5.6E-2	8.2E-3	0.0E0	1.4E-1	5.2E-2	46
.6E-2	1.4E-1	9.5E-3	1.7E-1	1.2E-1	2.3E-2	5.8E-2	0.0E0	5.7E-2	5.8E-2	1.5E-3	2.0E-1	0.0E0	1.2E-1	2.2E-2	47
.2E-2	6.2E-2	1.2E-1	3.9E-3	1.6E-1	2.7E-2	2.1E-1	0.0E0	1.6E-1	2.1E-1	1.9E-2	4.4E-2	0.0E0	4.4E-1	1.4E-1	48
.2E-2	6.2E-2	1.2E-1	3.9E-3	1.6E-1	2.7E-2	2.1E-1	0.0E0	1.6E-1	2.1E-1	1.9E-2	4.4E-2	0.0E0	4.4E-1	1.4E-1	49
.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	50
.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	51
.8E-2	9.4E-2	1.0E-1	2.1E-2	1.7E-3	4.5E-2	2.6E-2	0.0E0	1.4E-1	2.6E-2	2.9E-1	2.9E-2	0.0E0	2.7E-2	1.8E-1	52
.6E-2	4.8E-3	9.5E-3	1.7E-1	1.2E-1	1.5E-1	5.8E-2	0.0E0	2.3E-1	5.8E-2	2.4E-1	7.3E-2	0.0E0	1.2E-1	2.2E-2	53
.7E-1	8.8E-2	1.2E-1	7.9E-2	1.2E-1	2.7E-1	2.0E-2	0.0E0	7.4E-2	2.0E-2	1.6E-1	2.4E-1	0.0E0	1.6E-1	8.7E-2	54
.6E-3	3.5E-2	2.1E-2	6.9E-2	3.9E-2	5.2E-2	5.9E-2	0.0E0	3.9E-2	5.9E-2	2.5E-2	9.9E-2	0.0E0	7.2E-2	7.8E-2	55

31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	
.7E-2	3.3E-2	4.8E-2	0.0E0	4.8E-2	9.1E-2	7.5E-2	3.9E-2	2.2E-2	1.0E-1	0.0E0	1.0E-1	1.0E-1	7.0E-2	5.3E-2	46
.7E-2	9.7E-2	3.1E-2	0.0E0	3.1E-2	8.9E-2	1.5E-3	4.8E-3	9.5E-3	4.8E-3	0.0E0	4.8E-2	4.8E-3	8.9E-2	2.2E-1	47
.6E-1	1.2E-2	3.1E-1	0.0E0	3.1E-1	8.2E-2	1.9E-2	6.2E-2	1.2E-1	6.2E-2	0.0E0	3.6E-2	6.2E-2	1.8E-1	2.7E-2	48
.6E-1	1.2E-2	3.1E-1	0.0E0	3.1E-1	8.2E-2	1.9E-2	6.2E-2	1.2E-1	6.2E-2	0.0E0	3.6E-2	6.2E-2	1.8E-1	2.7E-2	49
.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	50
.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	0.0E0	51
.7E-3	6.2E-2	7.5E-2	0.0E0	7.5E-2	6.8E-3	3.6E-3	2.0E-1	1.5E-1	9.4E-2	0.0E0	1.1E-1	1.2E-1	2.3E-1	4.5E-2	52
.7E-2	9.7E-2	3.1E-2	0.0E0	3.1E-2	8.9E-2	1.5E-3	4.8E-3	9.5E-3	1.4E-1	0.0E0	7.8E-2	4.8E-3	9.8E-2	2.3E-2	53
.4E-2	3.9E-2	6.6E-2	0.0E0	6.6E-2	1.7E-1	1.9E-2	6.0E-2	5.7E-2	6.0E-2	0.0E0	2.2E-2	8.8E-2	4.9E-2	1.4E-1	54
.9E-2	1.0E-1	2.1E-2	0.0E0	2.2E-1	3.4E-2	2.5E-2	3.5E-2	2.1E-2	1.9E-1	0.0E0	8.9E-2	3.5E-2	6.0E-3	5.2E-2	55

46									
.2E-2	47								
.4E-1	1.2E-1	48							
.4E-1	1.2E-1	4.4E-1	49						
.0E0	0.0E0	0.0E0	0.0E0	50					
.0E0	0.0E0	0.0E0	0.0E0	0.0E0	51				
.3E-2	2.3E-2	2.7E-2	2.7E-2	0.0E0	0.0E0	52			
.4E-1	9.5E-3	1.2E-1	1.2E-1	0.0E0	0.0E0	2.3E-2	53		
.6E-2	5.7E-2	1.6E-1	1.6E-1	0.0E0	0.0E0	1.7E-3	5.7E-2	54	
.3E-1	1.1E-1	7.2E-2	7.2E-2	0.0E0	0.0E0	5.2E-2	1.1E-1	3.9E-2	55

ssage F: 1-tailed Fisher probabilities on recall of pairs of clauses

1														
.2E-1	2													
.0E-1	1.0E0	3												
.0E0	7.0E-1	5.9E-1	4											
.5E-1	1.0E0	7.6E-1	8.9E-1	5										
.0E-1	8.8E-1	1.0E0	5.9E-1	7.6E-1	6									
7E-1	2.7E-1	1.0E0	1.7E-1	8.7E-1	2.2E-1	7								
.0E0	1.0E0	8.3E-1	6.3E-1	1.0E0	8.3E-1	8.3E-1	8							
.0E0	1.0E0	9.5E-1	6.6E-1	4.3E-1	9.5E-1	9.6E-1	3.2E-1	9						
.1E-1	2.9E-1	6.1E-1	7.7E-1	1.2E-1	6.1E-1	2.2E-1	5.7E-1	1.5E-1	10					
.0E-1	8.7E-1	6.8E-1	4.7E-1	3.9E-1	6.8E-1	1.4E-1	9.5E-1	1.0E0	4.8E-2	11				
6E-1	7.0E-1	5.9E-1	3.8E-1	3.9E-1	5.9E-1	7.2E-1	6.3E-1	1.7E-1	4.9E-5	2.2E-1	12			
1E-1	3.8E-1	1.0E0	9.0E-1	7.4E-1	5.6E-1	8.8E-1	6.8E-1	1.9E-1	3.8E-1	1.0E0	9.7E-2	13		
3E-1	4.1E-1	1.0E0	8.3E-2	5.5E-1	7.3E-1	4.1E-2	1.0E0	4.7E-1	1.9E-1	2.2E-1	2.5E-1	5.9E-1	14	
6E-1	8.0E-1	1.0E0	1.2E-1	9.5E-1	1.0E0	8.5E-1	9.2E-1	6.8E-1	7.5E-1	2.7E-1	3.7E-1	6.4E-1	3.8E-1	15

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
6E-1	8.7E-1	1.0E0	4.1E-1	2.1E-1	1.0E0	4.0E-1	9.7E-1	7.9E-1	5.2E-1	1.5E-1	4.1E-1	9.8E-1	2.2E-4	1.5E-1	16
0E-1	5.1E-1	1.0E0	2.2E-1	3.9E-1	6.8E-1	7.1E-1	7.3E-1	5.4E-1	4.8E-2	1.6E-1	2.4E-3	3.0E-1	2.2E-1	6.1E-1	17
4E-1	3.2E-1	1.0E0	5.6E-1	7.0E-1	1.0E0	5.4E-2	9.8E-1	6.4E-1	3.1E-1	1.9E-1	5.6E-1	9.4E-1	6.1E-2	4.2E-1	18
4E-1	9.7E-1	5.1E-1	8.0E-2	9.6E-1	5.1E-1	5.3E-1	7.7E-1	1.0E0	5.8E-1	7.3E-2	6.9E-1	9.2E-1	4.6E-1	2.3E-1	19
8E-1	5.7E-1	8.5E-1	4.9E-1	4.6E-1	8.5E-1	6.0E-1	1.0E0	1.0E0	1.5E-1	2.8E-1	1.8E-1	2.2E-1	1.8E-1	3.0E-1	20
8E-1	6.7E-1	1.0E0	3.6E-1	3.2E-1	4.1E-1	5.6E-1	9.1E-1	8.3E-1	8.2E-2	2.8E-3	3.6E-1	7.5E-1	2.3E-1	9.0E-2	21
5E-1	1.0E0	9.0E-1	5.6E-1	6.9E-1	9.0E-1	9.7E-1	5.4E-1	1.0E0	8.8E-1	8.0E-1	9.0E-1	6.0E-1	7.3E-1	4.6E-1	22
0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	23
5E-2	1.0E0	8.5E-1	8.1E-1	1.4E-1	8.5E-1	9.9E-1	7.0E-1	2.7E-1	9.6E-1	9.2E-1	8.1E-1	8.4E-1	5.2E-1	7.3E-1	24
0E0	1.0E0	9.0E-1	9.0E-1	6.9E-1	9.0E-1	8.0E-1	5.4E-1	1.0E0	1.0E0	8.0E-1	9.0E-1	6.0E-1	7.3E-1	8.7E-1	25
.7E-1	6.2E-1	1.0E0	2.7E-1	5.4E-1	4.4E-1	6.3E-1	3.2E-1	3.1E-1	3.7E-1	2.1E-1	7.5E-1	1.9E-1	1.7E-1	6.8E-1	26
.9E-1	7.5E-1	1.0E0	8.0E-1	1.9E-1	1.0E0	7.3E-1	9.9E-1	8.7E-1	8.6E-1	4.3E-1	8.0E-1	8.6E-2	1.3E-1	8.2E-1	27
.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	28
.0E0	1.0E0	9.8E-1	4.1E-1	1.0E0	9.8E-1	7.8E-1	1.0E0	1.0E0	3.9E-1	3.2E-1	4.1E-1	4.4E-1	2.7E-1	8.3E-1	29
.3E-1	6.3E-1	8.3E-1	6.3E-1	8.8E-1	8.3E-1	5.1E-1	7.6E-1	1.0E0	9.8E-1	9.5E-1	9.8E-1	6.8E-1	2.7E-1	6.6E-1	30

16														
6E-1	17													
8E-2	3.3E-2	18												
6E-1	7.1E-1	6.8E-1	19											
7E-2	2.8E-1	2.5E-1	3.1E-1	20										
5E-1	2.2E-2	4.1E-2	7.4E-3	1.9E-1	21									
6E-1	8.0E-1	9.8E-1	6.8E-1	1.0E0	8.2E-1	22								
0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	23							
1E-1	6.3E-1	9.2E-1	9.9E-1	1.0E0	8.2E-1	4.8E-1	1.0E0	24						
5E-1	1.0E0	8.4E-1	6.8E-1	4.8E-1	9.8E-1	1.0E0	1.0E0	1.0E0	25					
3E-1	4.5E-1	5.0E-1	2.1E-1	2.2E-2	2.6E-2	4.0E-1	1.0E0	9.5E-1	7.8E-1	26				
6E-1	8.9E-1	8.8E-1	3.0E-1	2.7E-1	2.0E-1	5.3E-1	1.0E0	9.8E-1	5.3E-1	5.0E-3	27			
0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	28		
4E-1	3.2E-1	8.0E-1	4.9E-1	1.0E0	5.9E-1	9.8E-2	1.0E0	1.0E0	1.0E0	5.6E-1	6.3E-1	1.0E0	29	
9E-1	9.5E-1	8.8E-1	7.7E-1	7.0E-1	9.9E-1	5.4E-1	1.0E0	2.7E-1	5.4E-1	6.4E-1	7.9E-1	1.0E0	1.0E0	30

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
.0E0	5.7E-1	8.5E-1	4.9E-1	1.0E0	8.5E-1	8.9E-1	2.7E-1	2.7E-1	1.5E-1	6.3E-1	1.8E-1	5.4E-1	8.7E-1	3.0E-1	31
.5E-1	8.7E-1	4.6E-1	1.9E-1	2.1E-1	4.6E-1	9.0E-1	5.9E-1	2.8E-1	2.8E-1	6.3E-1	4.1E-1	3.0E-1	3.4E-1	4.1E-1	32
.0E0	2.3E-1	9.5E-1	1.0E0	4.3E-1	9.5E-1	6.0E-1	1.0E0	1.0E0	1.5E-1	5.4E-1	6.6E-1	6.9E-1	1.0E0	6.8E-1	33
.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	34
.0E0	2.3E-1	9.5E-1	6.6E-1	1.0E0	9.5E-1	6.0E-1	1.0E0	1.0E0	6.3E-1	5.4E-1	1.0E0	6.9E-1	4.7E-1	6.8E-1	35
.0E0	8.1E-1	7.3E-1	5.1E-1	8.3E-1	7.3E-1	2.2E-1	2.7E-1	6.7E-2	1.9E-1	6.6E-2	2.5E-1	8.3E-1	1.1E-1	7.3E-1	36
.0E-1	1.1E-1	1.0E0	4.9E-1	9.2E-1	1.0E0	6.6E-1	6.8E-1	6.9E-1	3.8E-1	1.1E-1	4.9E-1	6.0E-1	5.9E-1	3.2E-1	37
.2E-1	4.9E-1	1.0E0	7.8E-1	6.1E-1	1.0E0	6.0E-1	8.7E-1	4.6E-1	3.5E-1	1.2E-1	5.3E-1	8.9E-1	7.8E-1	7.3E-1	38
.0E0	2.5E-1	8.0E-1	9.3E-1	9.2E-1	1.0E0	7.7E-1	8.1E-1	1.0E0	9.1E-1	8.1E-1	9.9E-1	9.5E-1	7.0E-1	9.8E-1	39
.0E-1	8.7E-1	6.8E-1	7.3E-1	3.9E-1	6.8E-1	9.8E-1	7.3E-1	1.0E0	8.6E-1	1.6E-1	9.0E-1	3.0E-1	9.4E-1	2.7E-1	40
.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	41
.9E-1	3.4E-1	1.0E0	7.1E-1	6.8E-1	1.0E0	9.4E-1	4.3E-1	3.7E-1	3.4E-2	6.2E-1	2.3E-1	6.2E-1	5.6E-1	8.5E-1	42
.0E-1	8.7E-1	6.8E-1	4.7E-1	6.9E-1	1.0E0	7.1E-1	1.0E0	1.0E0	1.6E-1	3.9E-1	2.2E-1	9.3E-1	2.2E-1	2.7E-1	43
.0E0	5.0E-1	1.0E0	8.4E-2	1.0E0	8.8E-1	9.4E-1	6.3E-1	1.0E0	9.3E-1	8.7E-1	3.3E-1	3.8E-1	8.1E-1	3.7E-1	44
.6E-1	3.3E-1	5.9E-1	6.4E-1	6.8E-1	5.9E-1	4.4E-1	6.3E-1	1.0E0	5.3E-1	2.2E-1	3.8E-1	7.3E-1	7.7E-1	9.1E-1	45

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
4E-1	2.8E-1	6.7E-1	3.1E-1	1.0E0	5.1E-1	4.8E-1	1.0E0	6.4E-1	1.0E0	9.5E-1	1.0E0	1.0E0	1.5E-1	7.0E-1	31
.4E-1	1.5E-1	5.6E-1	4.1E-2	1.3E-1	1.4E-3	7.2E-2	1.0E0	4.1E-1	1.0E0	8.6E-2	3.6E-1	1.0E0	5.4E-1	8.5E-1	32
.9E-1	1.0E0	6.4E-1	7.4E-1	2.7E-1	3.4E-1	1.0E0	1.0E0	1.0E0	1.0E0	8.1E-1	8.7E-1	1.0E0	1.0E0	1.0E0	33
.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	34
9E-1	1.0E0	6.4E-1	2.3E-1	2.7E-1	8.3E-1	1.0E0	1.0E0	1.0E0	1.9E-1	8.1E-1	8.7E-1	1.0E0	1.0E0	3.2E-1	35
4E-1	2.2E-1	6.1E-2	7.3E-1	5.2E-1	7.5E-1	7.3E-1	1.0E0	5.2E-1	2.9E-1	4.1E-1	8.6E-1	1.0E0	2.7E-1	9.1E-1	36
4E-1	7.9E-1	5.0E-1	5.7E-1	2.2E-1	5.1E-1	9.1E-1	1.0E0	8.4E-1	9.1E-1	1.9E-1	4.8E-1	1.0E0	1.0E0	6.8E-1	37
4E-1	6.1E-1	5.1E-2	7.8E-1	3.7E-1	2.2E-1	9.9E-1	1.0E0	7.2E-1	6.2E-1	7.9E-1	8.1E-1	1.0E0	1.0E0	9.8E-1	38
2E-1	1.0E0	5.0E-1	3.2E-1	7.5E-1	9.6E-1	1.0E0	1.0E0	1.0E0	1.9E-2	7.8E-1	3.7E-1	1.0E0	1.0E0	4.2E-1	39
4E-1	1.0E0	9.5E-1	7.3E-2	6.9E-2	9.8E-2	8.0E-1	1.0E0	9.2E-1	8.6E-2	1.3E-2	5.5E-2	1.0E0	1.0E0	7.3E-1	40
0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	41
.8E-1	3.5E-1	6.9E-1	4.2E-1	5.7E-1	2.9E-1	1.2E-1	1.0E0	9.7E-1	9.8E-1	1.7E-1	5.9E-1	1.0E0	6.1E-1	9.9E-1	42
.3E-4	6.7E-1	5.0E-1	2.2E-1	6.9E-2	9.8E-2	3.8E-1	1.0E0	6.3E-1	1.0E0	7.0E-1	4.3E-1	1.0E0	3.2E-1	9.5E-1	43
.7E-1	1.7E-1	9.6E-1	4.8E-1	1.0E0	3.0E-1	1.0E0	1.0E0	1.0E0	1.0E0	6.2E-1	7.5E-1	1.0E0	1.0E0	1.0E0	44
.5E-1	4.7E-1	5.6E-1	2.2E-1	1.8E-1	8.2E-1	5.6E-1	1.0E0	4.9E-1	1.8E-1	9.0E-1	8.0E-1	1.0E0	4.1E-1	3.0E-1	45

31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
.1E-1														
.7E-1	2.8E-1													
.0E0	1.0E0	1.0E0												
.7E-1	7.9E-1	9.6E-2	1.0E0											
.8E-1	6.1E-1	4.7E-1	1.0E0	6.7E-2										
.4E-1	7.7E-1	6.9E-1	1.0E0	1.9E-1	1.2E-1									
.2E-1	8.5E-1	4.6E-1	1.0E0	4.6E-1	2.3E-1	1.4E-3								
.5E-1	9.9E-1	3.6E-1	1.0E0	3.4E-2	1.2E-1	2.2E-1	5.0E-1							
.2E-1	3.6E-1	9.5E-2	1.0E0	9.5E-2	9.4E-1	3.0E-1	6.1E-1	5.0E-1						
.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0					
.3E-1	2.3E-2	3.7E-1	1.0E0	8.5E-1	2.9E-1	3.7E-1	1.6E-1	6.3E-1	8.4E-1	1.0E0				
.3E-1	1.5E-1	5.4E-1	1.0E0	1.0E0	7.7E-1	7.9E-1	8.4E-1	8.1E-1	8.8E-1	1.0E0	3.5E-1			
.7E-1	8.7E-1	1.0E0	1.0E0	1.0E0	1.0E0	3.8E-1	4.9E-1	1.0E0	5.1E-1	1.0E0	3.4E-1	5.1E-1		
8E-1	6.5E-1	6.6E-1	1.0E0	1.7E-1	8.3E-2	9.7E-2	5.3E-1	4.1E-2	7.3E-1	1.0E0	7.1E-1	7.3E-1	1.0E0	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
.6E-1	3.7E-1	1.0E0	7.0E-1	4.4E-1	1.0E0	8.5E-1	9.9E-1	9.7E-1	7.5E-1	2.7E-1	3.7E-1	8.8E-1	3.8E-1	7.6E-1	46
.8E-1	7.5E-1	1.0E0	6.9E-2	7.0E-1	2.0E-1	5.7E-1	9.8E-1	9.7E-1	8.7E-1	1.9E-1	5.6E-1	5.0E-1	6.4E-1	8.1E-1	47
.0E0	1.2E-1	9.8E-1	1.0E0	1.0E0	9.8E-1	7.8E-1	1.0E0	1.0E0	3.9E-1	3.2E-1	1.0E0	1.0E0	1.0E0	8.3E-1	48
.0E0	1.2E-1	9.8E-1	1.0E0	1.0E0	9.8E-1	7.8E-1	1.0E0	1.0E0	3.9E-1	3.2E-1	1.0E0	1.0E0	1.0E0	8.3E-1	49
.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	50
.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	51
.8E-1	7.0E-1	5.9E-1	1.0E0	1.6E-1	1.0E0	4.4E-1	9.8E-1	1.0E0	2.9E-1	7.6E-2	9.5E-1	1.0E0	9.3E-1	9.1E-1	52
.8E-1	9.6E-1	2.0E-1	5.6E-1	9.2E-1	2.0E-1	5.4E-2	1.9E-1	6.4E-1	9.2E-2	1.9E-1	5.6E-1	5.0E-1	6.4E-1	8.1E-1	53
.0E-1	8.5E-1	1.5E-1	3.0E-2	9.8E-1	1.0E0	8.0E-1	3.0E-1	7.3E-1	9.7E-1	7.2E-1	8.2E-1	7.8E-1	9.6E-1	7.0E-1	54
.0E0	4.6E-1	1.0E0	8.5E-1	9.8E-1	7.1E-1	7.7E-1	6.8E-1	5.0E-1	5.5E-1	3.0E-1	8.5E-1	4.3E-1	7.0E-1	6.9E-2	55

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
.1E-1	6.1E-1	1.2E-1	2.3E-1	7.3E-1	9.0E-2	8.7E-1	1.0E0	7.3E-1	8.7E-1	3.6E-1	5.1E-1	1.0E0	8.3E-1	9.2E-1	46
.6E-1	1.9E-1	8.5E-1	1.3E-1	2.5E-1	4.4E-1	4.0E-1	1.0E0	9.2E-1	8.4E-1	5.0E-1	1.0E-1	1.0E0	8.0E-1	8.8E-1	47
.0E0	1.0E0	8.0E-1	4.9E-1	1.0E0	5.9E-1	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	48
.0E0	1.0E0	8.0E-1	4.9E-1	1.0E0	5.9E-1	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	49
.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	50
.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	51
.5E-1	9.0E-1	2.6E-1	4.5E-1	4.9E-1	6.2E-1	9.0E-1	1.0E0	9.7E-1	5.6E-1	1.0E0	8.0E-1	1.0E0	1.0E0	9.8E-1	52
.3E-1	8.0E-1	5.0E-1	1.3E-1	2.5E-1	1.7E-1	8.4E-1	1.0E0	9.9E-1	4.0E-1	5.7E-2	3.1E-1	1.0E0	8.0E-1	5.8E-1	53
.8E-1	9.3E-1	1.0E0	9.2E-1	9.7E-1	1.0E0	5.2E-1	1.0E0	3.6E-1	5.2E-1	9.8E-1	1.0E0	1.0E0	8.5E-1	7.3E-1	54
.4E-1	8.3E-1	8.4E-1	3.3E-1	5.8E-1	3.7E-1	3.3E-1	1.0E0	8.9E-1	3.3E-1	5.7E-1	2.7E-1	1.0E0	1.0E0	9.3E-1	55

31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	
.5E-1	4.1E-1	6.8E-1	1.0E0	9.7E-1	9.3E-1	3.2E-1	3.9E-1	5.8E-1	2.7E-1	1.0E0	2.5E-1	2.7E-1	3.7E-1	3.7E-1	46
.2E-1	2.7E-1	6.4E-1	1.0E0	6.4E-1	3.0E-1	5.0E-1	5.0E-1	8.3E-1	5.0E-1	1.0E0	3.7E-1	5.0E-1	3.2E-1	6.9E-2	47
.5E-1	5.4E-1	4.9E-2	1.0E0	4.9E-2	2.7E-1	4.4E-1	6.8E-1	2.0E-1	3.2E-1	1.0E0	6.1E-1	1.0E0	1.0E0	4.1E-1	48
.5E-1	5.4E-1	4.9E-2	1.0E0	4.9E-2	2.7E-1	4.4E-1	6.8E-1	2.0E-1	3.2E-1	1.0E0	6.1E-1	1.0E0	1.0E0	4.1E-1	49
.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	50
.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	1.0E0	51
.1E-1	8.5E-1	6.6E-1	1.0E0	6.6E-1	5.1E-1	7.3E-1	9.8E-2	1.7E-1	9.0E-1	1.0E0	2.3E-1	2.2E-1	1.0E0	3.8E-1	52
.2E-1	2.7E-1	6.4E-1	1.0E0	6.4E-1	3.0E-1	7.8E-1	8.1E-1	5.0E-1	1.9E-1	1.0E0	9.1E-1	8.0E-1	9.6E-1	5.6E-1	53
.6E-1	8.7E-1	9.8E-1	1.0E0	7.3E-1	1.3E-1	4.6E-1	6.3E-1	6.7E-1	7.2E-1	1.0E0	7.7E-1	9.3E-1	8.5E-1	1.9E-1	54
.8E-1	9.1E-1	5.0E-1	1.0E0	8.0E-2	4.0E-1	4.3E-1	4.2E-1	4.3E-1	1.1E-1	1.0E0	9.0E-1	5.8E-1	4.6E-1	8.5E-1	55

46									
.2E-1	47								
.3E-1	8.0E-1	48							
.3E-1	8.0E-1	2.4E-2	49						
.0E0	1.0E0	1.0E0	1.0E0	50					
.0E0	1.0E0	1.0E0	1.0E0	1.0E0	51				
.0E-1	8.3E-1	4.1E-1	4.1E-1	1.0E0	1.0E0	52			
.0E0	5.0E-1	8.0E-1	8.0E-1	1.0E0	1.0E0	8.3E-1	53		
.0E0	7.5E-1	8.5E-1	8.5E-1	1.0E0	1.0E0	8.2E-1	7.5E-1	54	
.0E0	2.4E-1	2.9E-1	2.9E-1	1.0E0	1.0E0	6.3E-1	2.4E-1	7.7E-1	55

ssage F: 'simplified' contingency coefficients

1																													
0	**2**																												
0	0	**3**																											
0	0	0	**4**																										
9	0	0	0	**5**																									
0	0	0	0	0	**6**																								
0	10	0	14	0	10	**7**																							
0	0	0	0	0	0	0	**8**																						
0	0	0	0	0	0	0	4	**9**																					
0	8	0	0	18	0	12	0	16	**10**																				
0	0	0	1	4	0	16	0	0	25	**11**																			
0	0	0	4	4	0	0	0	15	51	11	**12**																		
0	4	0	0	0	0	0	0	14	4	0	19	**13**																	
0	2	0	21	0	0	24	0	0	13	11	10	0	**14**																
3	0	0	18	0	0	0	0	0	0	9	5	0	5	**15**															
5	0	0	3	12	0	3	0	0	0	15	3	0	45	16	**16**														
0	0	0	11	4	0	0	0	0	25	15	40	8	11	0	5	**17**													
0	8	0	0	0	0	25	0	0	7	13	0	0	22	2	21	26	**18**												
0	0	0	21	0	0	0	0	0	0	22	0	0	1	11	0	0	0	**19**											
1	0	0	0	0	0	0	0	0	16	8	14	11	13	9	30	8	11	7	**20**										
0	0	0	5	7	2	0	0	0	21	38	5	0	11	20	6	29	26	35	13	**21**									
3	0	0	0	0	0	0	0	0	0	0	0	0	0	3	5	0	0	0	0	0	**22**								
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**23**							
20	0	0	0	16	0	0	0	6	0	0	0	0	0	0	3	0	0	0	0	0	1	0	**24**						
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**25**					
0	0	0	9	0	1	0	7	8	5	12	0	13	14	0	11	2	0	12	28	28	4	0	0	0	**26**				
0	0	0	0	13	0	0	0	0	0	2	0	20	17	0	15	0	0	8	9	13	0	0	0	0	37	**27**			
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**28**		
0	0	0	2	0	0	0	0	0	3	6	2	1	8	0	0	6	0	0	0	0	20	0	0	0	0	0	0	**29**	
17	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	**30**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
0	0	0	0	0	0	0	8	6	16	0	14	0	0	9	0	8	0	7	0	0	1	0	0	0	0	0	0	15	0	**31**
0	0	1	13	12	1	0	0	9	9	0	3	8	6	3	16	15	0	26	17	41	21	0	3	0	20	5	0	0	0	**32**
0	8	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	6	7	0	0	0	0	0	0	0	0	0	**33**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**34**
0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	6	0	0	0	0	11	0	0	0	0	4	**35**
0	0	0	0	0	0	12	9	23	13	23	10	0	18	0	6	11	22	0	0	0	0	0	0	7	3	0	0	8	0	**36**
0	19	0	0	0	0	0	0	0	4	18	0	0	0	7	0	0	0	0	11	0	0	0	0	0	13	0	0	0	0	**37**
0	1	0	0	0	0	0	0	3	6	17	0	0	0	0	0	0	25	0	5	11	0	0	0	0	0	0	0	0	0	**38**
0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	33	0	5	0	0	2	**39**
0	0	0	0	4	0	0	0	0	0	15	0	8	0	9	0	0	0	22	23	19	0	0	0	21	32	23	0	0	0	**40**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**41**
1	6	0	0	0	0	0	3	6	27	0	11	0	0	0	0	6	0	3	0	8	17	0	0	0	14	0	0	0	0	**42**
0	0	0	1	0	0	0	0	0	15	4	11	0	11	9	42	0	0	12	23	19	4	0	0	0	0	2	0	6	0	**43**
0	2	0	21	0	0	0	0	0	0	0	6	4	0	6	0	14	0	0	0	8	0	0	0	0	0	0	0	0	0	**44**
0	6	0	0	0	0	2	0	0	0	11	4	0	0	0	0	1	0	11	14	0	0	0	0	13	0	0	0	2	7	**45**
3	6	0	0	3	0	0	0	0	0	9	5	0	5	0	3	0	18	11	0	20	0	0	0	0	5	0	0	0	0	**46**
0	0	0	22	0	12	0	0	0	0	13	0	0	0	0	0	13	0	17	11	2	5	0	0	0	0	19	0	0	0	**47**
0	17	0	0	0	0	0	0	0	3	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**48**
0	17	0	0	0	0	0	0	0	3	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**49**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**50**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**51**
13	0	0	0	15	0	2	0	0	8	21	0	0	0	0	0	0	10	2	0	0	0	0	0	0	0	0	0	0	0	**52**
0	0	12	0	0	12	25	14	0	20	13	0	0	0	0	0	0	0	17	11	14	0	0	0	5	23	7	0	0	0	**53**
0	0	15	26	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	**54**
0	0	0	0	0	0	0	0	0	0	7	0	2	0	21	0	0	0	6	0	5	5	0	0	5	0	9	0	0	0	**55**

31																								
3	32																							
6	9	33																						
0	0	0	34																					
6	0	20	0	35																				
13	0	0	0	23	36																			
0	0	0	0	14	18	37																		
0	0	3	0	3	11	40	38																	
0	0	3	0	30	18	12	0	39																
0	5	20	0	20	0	8	0	0	40															
0	0	0	0	0	0	0	0	0	0	41														
11	29	6	0	0	8	5	15	0	0	0	42													
0	15	0	0	0	0	0	0	0	0	0	6	43												
0	0	0	0	0	0	4	1	0	0	0	6	0	44											
14	0	0	0	15	21	19	0	26	0	0	0	0	0	45										
0	3	0	0	0	0	7	3	0	9	0	10	9	6	5	46									
0	9	0	0	0	8	0	0	0	0	0	4	0	8	22	2	47								
15	0	31	0	31	8	1	0	12	6	0	0	0	0	2	0	0	48							
15	0	31	0	31	8	1	0	12	6	0	0	0	0	2	0	0	43	49						
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51				
0	0	0	0	0	0	0	19	14	0	0	11	11	0	4	0	0	2	2	0	0	52			
0	9	0	0	0	8	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	53		
7	0	0	0	0	17	1	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	54	
0	0	0	0	22	3	2	3	2	19	0	0	0	0	0	0	11	7	7	0	0	0	11	0	55

APPENDIX 5.10: EXPERIMENT V: PASSAGE F: QUALITATIVE ANALYSIS OF CLAUSE CLUSTERS

The overriding characteristic of Passage F was the very low level of clustering actually found. The following 'clusters' are based on Table 6.13.

Clauses 4, 54

No obvious relationship.

Clauses 7, 18

Both mention the donkey, but this may well be coincidence; otherwise, there is no particular reason for this association.

Clauses 10, 12, 17

These could be interpreted as representing a weak causal chain, but with an important link, the failure of the pulling and pushing, omitted. 10 and 12 are closely associated with each other, perhaps a result of their semantic similarity (ie a thematic relationship), though this may be a scoring artefact, though both would only be marked recalled if there was evidence from both in a script.

Clauses 14, 16, 43

Clauses 14 and 16 are closely related thematically, but it could, less plausibly, be argued that the content of the second is a likely consequence of the first (causal relation).

Clauses 19, 21, 32

The two most closely related clauses, 21 and 32 are very similar in content: they both imply lazy sleeping. The only connection between 19 and 21, except their physical proximity in the original passage, is description of location in relation to a building.

Clauses 25, 39

There seems to be no plausible connection between these clauses.

Clauses 26, 27, 40

Distant semantic relations between 40 and the other two clauses seem implausible: relationships of this remoteness could be argued for too many pairings of clauses in the passage. Clauses 26 and 27 are strongly connected by topic as well as being adjacent.

Clauses 33, 35, 48, 49

The two most closely associated clauses, 48 and 49 are clearly related causally and very predictably given the rest of the story. The content of 33 is similar to that of 48 (thematic relation) though a causal connection is feasible, albeit mediated by other actions. Apart from forming part of the sequence of events between 33 and 48/49, and this is not an obvious relation, clause 35 seems only spuriously included here.

Clauses 37, 38

A weak causal relation could be argued, but these two clauses seem most clearly related by common topic.

APPENDIX 6.1: EXPERIMENT I: PASSAGES 1A TO 3C: QUALITATIVE OBSERVATIONS BY CLAUSES

The qualitative analyses in this appendix are based on the omission frequency data of Appendix 5.1 and the clauses of the passages as set out and numbered in Appendix 1.1. The '01' and '6+' groups of clauses refer to those with omission frequencies (across the 18 subjects of Experiment I) of 0 or 1, and of 6 or more respectively.

Passage 1A

Of the '01' clauses, no.1 introduces the story as a whole, and nos. 6, 8, 11, 19, 22, 23, 25, 26, 28 and 30 supply most of the main events. The only main events missing from the list are clauses 12-16 describing the chase, one of which (no.14) was the second most omitted clause in the pasage. The absence of these clauses from the 01 list may be associated with several clauses all describing similar things, whereas the other main events in the passage tend to be rpresented by just one clause. The impression was gained that many subjects were confused by this section, which became condensed or telescoped. A similar impression of confusion and condensation was gained from clauses 10, 11, 17 and 18, which dealt with looking for and finding signs of the armadillo.

Clause 7 is not obviously an essential part of the narrative, but relates to the way clues of the armadillo were first noticed. There seems less reason for the high recall level of clauses 2 and 3, although 'grandfather' and 'poison arrows', the main items introduced, are both prominent later in the passage, and both clauses may be described as setting the scene or background for the action. Alternatively, clauses 2, 3 and 7 may simply be instances of relatively unimportant detail occurring early in a passage being preferentially recalled. Clearer examples of this will be seen in later passages.

Passage 1A gave just 4 6+ clauses, fewer than any other passage. Of these, clauses 14, and 10 and 17 are associated with the condensation already discussed. More problematical is clause 24: an examination of subjects' scripts showed that its relationship with surrounding clauses was often misunderstood. There was some confusion with no. 21 and possibly even no. 14.

Passage 1B

The main plot of Passage 1B is almost wholly contained in the 01 list: the only other clauses of importance are nos. 9 and 10, which do not appear in either list. Interestingly, these largely repeat each other, and condensation by subjects, affecting recall or marking, may have kept them boh from the 01 group. In this list, 3 clauses do not seem essential of the story: nos. 2, 3 and 7, all of which supply background detail that would affect the overall passage little if it were omitted. These clauses may have been affected by their early position in the passage.

Of the 6+ clauses of Passage 1B, nos. 12, 15 and 16 introduce unimportant detail that could be deduced from the surrounding clauses yet which would make little difference to the story by being left out. Of the other 6+ clauses, all may be said to be of little importance insofar as their omission would not affect the overall passage, but they differ somewhat from clauses 12, 15 and 16 by representing events that might have been assumed had mention of them been omitted. In other words, clauses 19, 20, 23, 27, 29 are all to some degree inferable from context. Many similar examples can be found in the 6+ lists of the other passages.

Passage 1C

Passage 1 is notable in having very few 01 clauses: 4 at the beginning and

2 at the very end. Clause 3 definitely begins the story, and no. 6 is perhaps the next important step in the plot, the first of many devoted to what happens to some metal to produce a vacuum cleaner. Clause 29 and 30 provide an almost 'punchline' ending. Although they provide background and justification for what follows, the author was uncertain whether clauses 1 and 2 were as 'important' to the story as many others; whatever their actual importance, their recall may well have been affected by coming early in the passage.

Among the 6+ clauses, nos. 18-24 form a continuous block, much of which subjects seemed not to fully understand: clauses 21-23 are not further steps in the manufacturing process, and might therefore be described as particularly unimportant. Clause 5 might be expected to have been better recalled because of the way it sets the scene for the early action. So many activities and places were mentioned in the passage, however, that a certain amount of confusion among them by subjects was inevitable. For all of clauses 5, 9, 10 and 13 there aappears to be no special reason for the high omission scores, but as these are all marginal in terms of group 6+ membership, they are best ascribed to chance.

The higher omission frequencies of clauses 11 and 15 require explanation, no. 11 being omitted more often than any other clause in the whole experiment. Clause 11 adds little to the passage and is probably highly inferrable from context: perhaps it is so likely that something washed will be dried that drying hardly deserves mention. Clause 15 is like many others that have to do with attachment and pieces of metal (cf nos. 6, 14, 18, 25), which might have led to the sort of confusion among clauses already noted.

Passage 2A

Like Passages 1A and 1B, nearly all the 01 clauses in 2A describe events central to the action of the whole passage. The only important clauses missing are nos. 13 and 16: of these it might be argued that 13 represents partial repetition of earlier material (clause 8) or is an inference from it, and perhaps clause 16 is implied by clause 21, but no great confidence can be attached to these suggestions. Among the 01 clauses, no. 3 seems less essential than the others; its inclusion in the list might be due to its early position in the passage.

Of the most frequently omitted clauses, no.8 can probably be inferred from context (eg clauses 6 and 11); no. 14 essentially repeats no.6; and no. 15 is implied, *inter alia*, by no. 14, is almost another repeat of no. 6 and is so closely tied to no. 14 in the text that the two clauses might be expected to be omitted and recalled as one. Clauses 18-20 form a small block that repeats or is impied by others such as nos. 11, 12 and 17. Finally, clause 25, by stating the outcome of clauses 22 and 23, really coneys only information that would have deduced by the reader were it to be omitted from the passage completely, or simply replaced by 'then'.

Passage 2B

Of the 01 clauses, nos. 1, 3, 25, 27 and 28 certainly represent major elements of the plot, at the beginning and end of the passage, but between these are a number of brief 'episodes' where various toys are seen, and where Mrs Taylor waits patiently or moves on. Each of the first 3 episodes is represented by one clause in the 01 group (nos. 5, 12 and 19); that these include explicit mention of each of the toys in question may be partly a marking artefact. The moving on is included too (no. 10), but the waiting (no. 21) is, curiously, among the least well recalled clauses. Perhaps the whole story implies that Mrs Taylor is waiting for her children.

Of the 6+ clauses, only one (no. 23) was omitted by more than 6 subjects, and then only by 8. All 5 of these clauses may therefore be particularly arbitrarily selected. Nevertheless, nos. 9 and 14 contain description or detail that is distinctly peripheral to the main concerns of the passage, and clauses 23 and 24 seemed to cause subjects special difficult, as if they did not understand them or could not express what they recalled in words.

In retrospect, the central section of Passage 2B (clauses 5-24), like that of Passage 1C, appears to be more typical of a 'nodal' passage. It is, however, still not clear why so few clauses of Passage 2B were omitted by more than a handful of subjects.

Passage 2C

As before, most of the plot of this is passage is contained in the 01 clauses. From earlier findings, one might have expected confusion among the rather similar clauses 10, 11 and 17, perhaps with the frequent omission of n. 17 and the contraction of intervening events. This did not happen, possibly because of the importance and resistance to omission of the clauses between, that they were not in themselves repetitious (unlike clauses 12-16 of Passage 1A), and because the two occasions of things dropping from the razor were associated with two different people who could not possibly be confused with each other. Clauses 8 and 30 might have been expected in the 01 list, but their higher omission may be just a matter of chance. Clauses 22-26 explain many of the preceding events and might also be thought important, but a considerable amount of confusion and misunderstanding of this section in subjects' scripts was evident, perhaps associated with the unfamiliarity of some female subjects with the activity of shaving, or due to a lack of clarity in the phrasing of the original passage.

Another area of confusion was the frequent references to surprise or alarm (clauses 3, 5, 6, 7 and 18), some of which were transposed or swapped around at recall. Clause 5 is the only one in the 01 group, 6 and 7 appearing in the 6+ list. The high omission frequency of 7 may be associated with its being the third statement about a noise in 3 successive clauses, all of which labour its unusualness. Of the remaining 6+ clauses, no. 4 in part duplicates no. 1, or is sufficiently deduceable from clauses 3 and 5 that had itbeen omitted originally, there would have been loss of meaning; clause 9 contains one obvious justification for the content of clause 8 and is readily inferable too, as might be clauses 15 and 21: neither can be easily inferred from its context, yet neither would alter the meaning of the rest of the passage were it to be omitted.

Passage 3A

Passage 3A contains fewer 01 clause than any other pasage - just the first clause and no. 9 which introduces the unicorns. There is certainly nothing special about nos. 2-4. One might have expected at least to find the dramatic conclusion (clause 30) here too, although it does relate directly to little or nothin that went before.

Of the 6+ clauses, 7 form, perhaps fortuitously, one continuous sequence which discusses the activities of the uhnicorns and introduces and discusses the dragon. If we regard the central section of 3A to be clauses 6-29, then 6 topicsare introduced, relating tothe a *priori* stucture of the passage, and dealing with serpents, unicorns, the dragon, man, the river and the sky. From previous results, one might have expected that the introduction to these topics would be better recalled than their discussion. Of the 6 introductory clauses (nos. 7, 9, 14, 18, 23 and 26), only no. 14 appears in the 6+ list (and barely so), one (no. 9) appears in the 01 list, and 4 are in the intermediate category. Eleven of the 12 6+ clauses *discuss* these topics, whereas none of the 01 clauses do (unless nos. 2-4 are included). Thus there is some confirmation for the expectation.

Clauses 24 and 29 show particularly high omission frequencies and require special attention. No. 24 is another instance of partial repetition (of clauses 9 and 10 perhaps), but there seems little special about clause 29, unless it is an inference from 28, itself poorly recalled.

Passage 3B

The 01 list for this passage includes both the introductory and concluding clauses, as well as a few early clauses (4, 5 and 9) and nos. 21 and 27. Clause 4 might be taken to provide background for the rest of the passage, and clauses 5 and 21 appear to introduce sectons of the passage. Clause 9 can only be decribed as prominent detail occurring fairly early in the passage, there being no obvious reason for its favoured recall. Similarly, the author can see no clear cause of the high recall level of no. 27, which actually repeats some of the information present in or inferable from surrounding clauses. This may be another scoring artefact: for example, many subjects might have used the word 'plant' when recalling one or more of clauses 26-29, increasing the tendency for the Experimenter to score what was reproduced as coming from clause 27.

Of the 6+ clauses, all but clause 13 can be argued to represent unimportant and largely descriptive material which does not introduce new topics or sections. No 13, by introducingthe builders who had done things to the walls, is an exception. Examination of subjects' scripts suggests several factors that might have been involved: there was considerable confusion in subjects' minds among the actors of the passage (decorators, architects, plumbers etc), 'builders' had often been mentioned by subjects before clause 13; and many subjects assumed the walls belonged to the kitchen, running their account straight on between the two topics and leaving no break in which to introduce the builders, ie another case of 'contraction' or as many others in the list, but even when it was recalled, subjects seemed unable to express properly what they could remember.

Passage 3C

Again, this passage demonstrates considerable selection for the earliest clauses, 6 of the first 8 appearing in the 01 group, of which only nos. 1 and 2 could be said to introduce or provide background for the rest of the passage. The preferential recall of clauses 18 and 24 remain unexplained, unless the words 'computer' and 'Hawker Siddeley' were particularly noticeable (any reproduction of these would be ascribed to those clauses).

The 6+ list consists of 16 clauses, 4 more than for any other passage. It includes all but 6 of the clauses between nos. 9 and 30. Discussing all of them is probably pointless because most have omission frequencies of just 7 or 8 and may repreent a fairly generally depressed level of recall over much of the passage. The 5 clauses omitted most often are worth closer scrutiny: nos. 13 and 15 both discuss the machine's bodywork, already mentioned in other clauses, and are to that extent repetitious. The others (nos. 14, 22 and 29) all seem highly inferable in their context: batteries tend to be rechargeable, automatic controls may well be more accurate, and academic courses frequently end in exams and certificates of some sort.

APPENDIX 6.2: EXPERIMENT I: PASSAGES 1A, 2C AND 3B: OVERALL OMISSION OF WORDS AVERAGED BY SERIAL BLOCKS OF 9

Block no.	-----Omissions----- 1A	2C	3B	mean
1	1.6	4.9	2.5	3.0
2	2.2	6.7	7.2	5.4
3	5.7	7.2	5.2	6.0
4	5.9	9.9	5.1	7.0
5	4.9	9.0	7.7	7.2
6	5.2	7.1	8.7	7.0
7	4.0	9.4	7.0	6.8
8	8.8	2.5	7.0	6.1
9	9.1	2.3	7.3	6.2
10	7.2	4.8	5.7	5.9
11	10.2	10.8	10.0	10.3
12	11.1	13.7	8.6	11.1
13	10.6	2.2	4.0	5.6
14	7.7	6.9	7.5	7.4
15	9.8	5.0	8.5	7.8
16	10.3	6.8	8.0	8.4
17	5.4	8.2	9.6	7.7
18	6.7	5.3	10.9	7.6
19	7.2	5.5	4.3	5.7
20	7.2	7.2	9.1	7.8
21	7.5	5.2	7.6	6.8
22	4.6	5.9	8.6	6.4
23	9.6	8.2	9.9	9.4
24	8.4	4.4	9.6	7.5
25	4.2	2.8	1.2	2.7

APPENDIX 6.3: EXPERIMENT I: PASSAGES 1A, 2C AND 3B:
50% OF WORDS MOST AND LEAST FREQUENTLY OMITTED

Passage 1A (CAPITALS = 5 or fewer omissions; lower case = 6 or more)

ONE DAY ERNU DECIDED TO HUNT THE GIANT ARMADILLO. HE WENT TO HIS GRANDFATHER FIRST AND BORROWED SOME of his POISON ARROWS, THEN VISITED the village shrine AND PRAYED TO his tribe's ancestral SPIRITS. after this HE WALKED deep INTO THE FOREST where he SLEPT the night ON some DRY LEAVES IN A CAVE. EARLY IN THE MORNING HE was WAKENED by A NOISE, and CREPT OUT of the cave into THE moonlight. at first HE could see nothing except THE misty river banks, but eventually NOTICED A humped SHAPE some way off. suddenly the shape VANISHED into the forest. ernu RAN after it. he plunged into the undergrowth, bow and arrows in hand. he FOLLOWED THE animal's tracks FOR over HALF AN HOUR, until he came out INTO A swampy clearing. he looked around for a while before ESPYING A shadowy DEPRESSION IN THE UNDERGROWTH: quickly HE FIRED SEVERAL ARROWS INTO IT. there WAS A loud ROAR. HE RAN OVER and found THE fabulous giant ARMADILLO, but it WAS already quite DEAD. ERNU jumped among the bushes TO SKIN THE MONSTER of its tough, legendary HIDE. THEN HE had to DRAG THE BULK BACK THROUGH the forest, and after many hours reached his tribe's VILLAGE. he showed the hide to HIS GRANDFATHER who WAS SO PROUD that HE GAVE ERNU A fine TIMBER HUT.

Passage 2C (CAPITALS = 5 or fewer omissions; lower case = 6 or more)

in trying TO SHAVE ONE MORNING, which is always A DISMAL PROSPECT before breakfast, i FOUND to my surprise, on switching on, that THE MOTOR MADE A most DISTURBING GRATING SOUND, which alarmed me at first. indeed i had never heard its like before. I TOOK THE BACK of the razor OFF to look inside for anything amiss, when A DOZEN tiny CURLICUES of METAL FELL OUT and disappeared INTO THE CARPET. I then SHOWED THE RAZOR TO A FRIEND WHO KNEW a lot ABOUT SUCH MATTERS, or so he LET others BELIEVE. he said he did not look the look of the steel fragments, and then HE TOOK THE BACK OFF, WHEREUPON SOME PIECES OF CHARRED PLASTIC RATTLED TO the floor, ALARMING me even more, because THERE COULDn't HAVE BEEN MUCH LEFT INSIDE by then. but MY FRIEND placed the razor on the table, where the sunlight glistened on the rust. HE GAVE ME a few WORDS of advice: I SHOULD HAVE FOUND OUT long ago how TO USE AN ELECTRIC RAZOR and how to manage WITHOUT the SOAP AND razor blades which HAD had such a DELETERIOUS effect. I WALKED HOME disheartened and went to have a shave in the bathroom, GETTING OUT AN OLD CUT-THROAT WITH MY LEFT HAND, AND WITH MY RIGHT TOSSING THE BATTERY RAZOR THROUGH THE WINDOW.

Passage 3B (CAPITALS = 7 or fewer omissions; lower case = 8 or more)

IT WAS INDEED A BEAUTIFUL HOUSE. THE DECORATORS HAD TRIED THEIR BEST with THE DECOR. each room represented a different PERIOD: ONE SAW CLASSICAL, GEORGIAN AND ULTRAMODERN ROOMS immediately ADJACENT. the plumbers HAD INSTALLED A SOLID SILVER BATH AND connected it to unbelievably QUIET water-PIPING, hidden from sight, WHICH was TO WIN AN important INDUSTRIAL AWARD. glittering CRYSTAL TAPS projected FROM THE FOOT of the bath. THE KITCHEN HAD been uniquely fitted out: one wall HOUSED A DEEP-FREEZE THE SIZE OF A SMALL ROOM, and THE FLOOR WAS SUPPOSEDLY SELF-CLEANING. the builders had taken trouble to enhance THE WALLS by FUSING their surfaces with OXYACETYLENE TORCHES SO THAT THEY ACQUIRED A GLASS-LIKE FINISH, and by USING BLUE-tinted CONCRETE. HEATING was provided by large CEILING PANELS which were NO FIRE HAZARD due to their low temperature. the ARCHITECTS HAD CHOSEN the site of THE HOUSE and had positioned it CAREFULLY in relation to the terrain so that it NESTLED IN ITS LANDSCAPING AS A CHICK snuggles IN A HEN'S NEST. the site also provided the maximum protection from the elements. the NURSERYMEN HAD been hired FROM A BOTANICAL GARDENS, and they PLANTED many exotic SHRUBS, distributing them in clusters so as to LEND AN almost SUBTROPICAL AIR to the setting. both BRIDE AND GROOM WERE OVERJOYED WITH THEIR NEW HOME.

APPENDIX 6.4: EXPERIMENT I: PASSAGES 1A, 2C AND 3B: THE 30 OR SO WORDS MOST AND LEAST FREQUENTLY OMITTED

Omission frequency	Words and clause numbers
	Passage 1A
0	(1) Ernu decided to hunt the armadillo; (2) he; (3) poison arrows; (7) slept; (11) a; (19) fired; (23) dead; (25) skin; (26) drag the bulk.
1	(2) went to grandfather; (3) borrowed; (4) then; (6) walked; (8) the morning he; (22) armadillo; (26) back; (28) grandfather; (30) Ernu a hut.
13	(4) village; (12) suddenly; (18) before; (25) off; (27) and his; (28) showed the hide; (29) who.
14	(6) deep; (9) and; (11) some way off; (14) into arrows; (16)out; (17) looked around; (28) he.
15	(27) tribe's.
16	(14) he plunged in hand; (17) for a while; (28) to.
18	(19) quickly.
	Passage 2C
0	(1) shave; (10) curlicues metal fell; (12) I showed; (13) who knew about such matters; (14) let believe; (17) plastic; (25) soap.
1	(5) the motor sound; (8) took; (11) into the carpet; (12) the razor to a friend; (17) pieces rattled to; (22) gave words; (25) and; (27) I walked; (29) a cut-throat; (30) razor.
13	(8) of; (9) to look; (16) and; (17) the floor; (28) in bathroom.
14	(7) indeed; (9) anything amiss; (15) he did steel.
15	(5) most; (15) he said -n't like the look of the fragments.
16	(9) for; (12) then.
17	(5) that; (9) inside; (16) then; (25) now.
18	(6) at first.
	Passage 3B
0	(5) silver bath; (9) taps; (30) bride and groom were overjoyed.
1	(1) was beautiful house; (4) classical Georgian and ultramodern; (30) home.
2	(5) a; (9) crystal; (10) kitchen; (14) walls; (21) the house; (23) nestled; (24) as a chick in; (30) with.
13	(10) fitted out; (13) taken trouble; (15) by; (22) in to; (25) maximum; (29) the setting.
14	(8) important; (14) to enhance; (22) it; (28) distributing; (29) almost.
15	(6) it; (7) from sight; (15) surfaces; (18) large; (22) and had; (25) the; (27) they exotic.
16	(27) relation; (28) them.
18	(29) to.

APPENDIX 6.5: EXPERIMENT I: PASSAGES 1A, 2C AND 3B:

PARTS OF SPEECH FOR ANALYSES

Passage 1A

Nouns day armadillo grandfather arrows poison village shrine tribe's spirits forest night leaves cave morning noise cave moonlight nothing river banks shape way shape forest arrows hand bow undergrowth animal's tracks hair clearing while depression undergrowth arrows roar armadillo bushes monster hide bulk forest hairs tribe's village hide grandfather timber hut

Verbs decided hunt went borrowed visited prayed walked slept wakened crept see noticed vanished van plunged followed came looked espying fired was ran found was jumped skin drag reached showed was gave

Adjectives one giant poison some ancestral some day early misty humped some half swampy shadowy several level fabulous giant dead tough legendary many proud fine timber

Adverbs first deep first eventually suddenly over around quickly already quite back so

Passage 2C

Nouns morning prospect breakfast surprise motor sound like back razor anything curlicues metal carpet razor friend matters look fragments steel back pieces plastic floor friend razor table sunlight rust words advice razor soap razor blades effect home shave bathroom cut-throat hand right battery razor window

Verbs trying shave is found switching made grating disturbing alarmed heard took look fell disappeared shaved knew let believe said like took rattled charred alarming been left placed glistened gave found used manage had walked went have getting tossing

Adjectives one dismal disturbing grating amiss dozen tiny lot such steel some charred much left few electric deleterious disheartened old left right

Adverbs most first never before inside even more -n't inside long ago such home

Passage 3B

Nouns house decorators decor room period rooms plumbers bath silver water- -piping sight award taps foot bath kitchen wall freeze size room floor builders trouble walls surfaces torches glass- finish concrete heating ceiling panels fire hazard temperature architects site house terrain relation landscaping chick hen's nest site protection elements nursery- -men gardens shrubs clusers air setting bride groom home

Verbs was tried represented saw installed connected hidden win projected fitted housed was -cleaning taken enhance fusing acquired using -tinted heating provided were due chosen positioned netled snuggles provided hired planted distributing lend were

Adjectives beautiful each different ultramodern adjacent Georgian solid silver quiet hidden important industrial glittering crystal one deep- small self-cleaning
oxyacetylene glass-like blue- -tinted large no low maximum botanical many exotic subtropical overjoyed both new

Adverbs indeed best unbelievably uniquely supposedly carefully also almost

APPENDIX 6.6: EXPERIMENT I: PASSAGES 1A, 2C AND 3B: NEAR-VERBATIM RECALL: WORDS SHOWING 4 OR MORE EXAMPLES

Overall recall frequency	Clause no.	Original word and verbatim frequency	Near-verbatim forms and frequencies
Passage 1A			
15	8	wakened (3)	awoken (4), woke (3), awakened (2), awoke (1), woken (1)
18	3	poison (9)	poisoned (9)
12	16	into (1)	to (8), in (1)
18	25	skin (8)	skinned (4), skinning (3), skins (1)
18	26	drag (7)	dragged (6), dragging (2)
16	5	prayed (6)	pray (8)
17	2	grandfather (11)	grandfather's (5), father (1)
18	7	slept (7)	sleep (3), sleeping (2), sleeps (1)
11	5	tribe's (4)	tribal (4), tribe (1)
Passage 2C			
18	13	knew(5)	know (8), knows (4), knowledgeable (1)
12	19	-n't (3)	not (8)
18	18	shave (11)	shaving (7)
17	1	into (9)	in (4), to (3)
14	19	been (5)	be (5)
10	21	sunlight (5)	sun (4), sun...highlighted (1)
17	29	an (12)	a (4)
16	5	a (12)	an (4)
13	18	alarming (1)	alarmed (4)
Passage 3B			
12	23	in (5)	into (7)
11	16	they (1)	them (6), their (1)
11	29	an (4)	a (7)
12	8	win (3)	won (6)
15	6	-piping (7)	pipes (3), pipe (2)
15	26	gardens (10)	garden (4), gardeners (1)
14	27	planted (9)	plant (3), plants (2)
11	15	fusing (2)	fused (5)
11	17	using (3)	used (4), use (1)
15	29	subtropical (10)	tropical (4)
11	23	landscaping (1)	landscape (1), land (1)
6	15	their (1)	them (4)

APPENDIX 6.7: EXPERIMENT I: PASSAGES 1A, 2C AND 3B: MEAN VERBATIM TENDENCY OF WORDS AND OVERALL RECALL FREQUENCY

Overall recall frequency	Mean verbatim recall tendencies			
	1A	2C	3B	ALL
0	0.00*+	0.00*+	0.00*+	0.00*+
1	0.00**	0.75*	0.00**	0.75*
2	0.75*	0.50*	0.50*	0.67
3	1.00*	0.83	0.63	0.74
4	0.55	0.63*	0.54*	0.57
5	0.72	0.73*	0.50	0.65
6	0.76*	0.58*	0.81*	0.72
7	0.79	0.61*	0.59	0.68
8	0.81	0.70*	0.65	0.72
9	0.76	0.75	0.63	0.71
10	0.78	0.79	0.65	0.73
11	0.65	0.70	0.62	0.65
12	0.79	0.72	0.74	0.76
13	0.71	0.80	0.75	0.75
14	0.73	0.67	0.70	0.70
15	0.76	0.68	0.71	0.71
16	0.95	0.70	0.88	0.81
17	0.82	0.72	0.92*	0.83
18	0.89	0.74	0.87*	0.83

APPENDIX 6.8: EXPERIMENT I: PASSAGES 1A, 2C AND 3B:

50% OF WORDS MOST AND LEAST FREQUENTLY RECALLED VERBATIM

Words recalled verbatim on at least 80% of occasions in capitals.

Passage 1A

ONE DAY ERNU DECIDED TO HUNT THE GIANT ARMADILLO. HE WENT TO HIS GRANDFATHER FIRST and borrowed SOME OF HIS POISON ARROWS, THEN visited THE VILLAGE SHRINE and PRAYED TO his TRIBE'S ancestral spirits. after this HE walked deep INTO THE FOREST where HE slept THE NIGHT ON SOME DRY LEAVES IN A CAVE. EARLY in THE MORNING HE WAS WAKENED BY A NOISE, AND crept out of THE CAVE INTO THE MOONLIGHT. AT FIRST HE COULD SEE nothing except THE MISTY RIVER BANKS, but eventually noticed A HUMPED shape some way off. suddenly the shape vanished INTO THE FOREST. ernu ran after it. HE plunged into THE UNDERGROWTH, BOW AND ARROWS in hand. he followed the animal's TRACKS FOR over HALF AN HOUR, until HE came out INTO A SWAMPY CLEARING. HE LOOKED AROUND FOR A while before espying A shadowy depression IN THE undergrowth: quickly HE fired several arrows INTO it. THERE was A loud roar. he ran over AND found THE fabulous GIANT ARMADILLO, BUT it was ALREADY quite DEAD. ernu jumped among THE BUSHES TO SKIN the monster OF ITS tough, LEGENDARY hide. then HE HAD TO DRAG THE bulk BACK through THE FOREST, and after many hours reached HIS TRIBE'S VILLAGE. HE SHOWED THE HIDE TO HIS GRANDFATHER who WAS SO proud THAT HE gave ernu A FINE timber HUT.

Passage 2C

in trying to SHAVE ONE MORNING, WHICH IS ALWAYS A dismal prospect BEFORE BREAKFAST, I found to my surprise, on SWITCHING ON, THAT the motor made A most disturbing GRATING sound, WHICH alarmed ME at first. indeed I HAD NEVER HEARD its like BEFORE. I took THE BACK OF the razor off TO look INSIDE for anything amiss, when a dozen tiny curlicues OF METAL FELL out AND disappeared INTO THE CARPET. I THEN showed the razor TO A FRIEND WHO KNEW A lot ABOUT such matters, OR so HE let others believe. HE SAID HE did not like THE look OF THE steel fragments, and THEN HE took THE BACK off, whereupon some pieces OF CHARRED PLASTIC rattled to THE FLOOR, alarming me even more, because THERE COULDN'T have been MUCH LEFT INSIDE BY then. but my friend placed the razor ON THE TABLE, where THE SUNLIGHT glistened on THE RUST. he gave ME a few words OF ADVICE: I should have found out long ago HOW TO USE AN ELECTRIC RAZOR AND how to manage without THE SOAP AND RAZOR BLADES WHICH HAD had such a deleterious EFFECT. I walked HOME disheartened AND went TO have a SHAVE in THE BATHROOM, getting out AN OLD CUT-THROAT WITH MY LEFT HAND, and WITH MY RIGHT tossing THE battery RAZOR through THE WINDOW.

Passage 3B

IT WAS indeed A BEAUTIFUL HOUSE. THE decorators HAD tried their best with the decor. each ROOM represented a DIFFERENT period: ONE saw CLASSICAL, GEORGIAN AND ULTRAMODERN ROOMS immediately adjacent. THE plumbers had installed a SOlID SILVER BATH and connected it TO unbelievably quiet water-PIPING, hidden from sight, WHICH was to win AN important INDUSTRIAL AWARD. glittering CRYSTAL TAPS projected from THE foot OF THE BATH. THE KITCHEN had been uniquely fitted out: ONE WALL housed a DEEP-FREEZE THE SIZE OF A SMALL ROOM, AND THE FLOOR WAS supposedly SELF-CLEANING. THE builders HAD TAKEN trouble to enhance THE WALLS by fusing THEIR surfaces WITH OXYACETYLENE torches so that they acquired A glass-like finish, AND by using BLUE-tinted concrete. HEATING was provided by large CEILING PANELS which were no FIRE hazard due to THEIR low temperature. THE ARCHITECTS had chosen THE SITE of THE HOUSE AND had positioned it carefully IN relation TO the terrain SO THAT it nestled IN its landscaping as A CHICK snuggles IN a hen's NEST. the site ALSO provided the maximum protection FROM THE elements. the nurserymen HAD BEEN hired FROM a BOTANICAL GARDENS, and THEY PLANTED many EXOTIC shrubs, distributing them in clusters so as to lend AN almost SUBTROPICAL air to THE setting. BOTH BRIDE AND GROOM WERE overjoyed WITH THEIR NEW home.

APPENDIX 6.9: EXPERIMENT I: PASSAGES 1A, 2C AND 3B: MEAN VERBATIM TENDENCY OF WORDS AND SERIAL POSITION

Block no. (9 words)	Passages			
	1A	2C	3B	ALL
1	0.96	0.76	0.90	0.87
2	0.87	0.69	0.48	0.68
3	0.89	0.64	0.79	0.77
4	0.54	0.64	0.66	0.61
5	0.77	0.84	0.64	0.75
6	0.96	0.70	0.63	0.76
7	0.90	0.45	0.64	0.66
8	0.82	0.90	0.69	0.80
9	0.80	0.81	0.55	0.72
10	0.69	0.76	0.95	0.80
11	0.44	0.69	0.82	0.65
12	0.66	0.84	0.77	0.76
13	0.76	0.67	0.45	0.63
14	0.78	0.55	0.77	0.70
15	0.82	0.77	0.73	0.77
16	0.58	0.50	0.67	0.58
17	0.74	0.83	0.72	0.76
18	0.71	0.76	0.66	0.71
19	0.80	0.58	0.69	0.69
20	0.71	0.61	0.58	0.63
21	0.68	0.84	0.70	0.74
22	0.82	0.67	0.83	0.77
23	0.70	0.72	0.41	0.61
24	0.87	0.89	0.75	0.80
25	0.83	0.73	0.81	0.79
overall	0.762	0.696	0.692	0.717

APPENDIX 6.10: EXPERIMENT I: PASSAGES 1A, 2C AND 3B: WORDS OF HIGHEST AND LOWEST VERBATIM TENDENCIES

Clause numbers in parentheses.

* no overall recall, so verbatim tendency set to zero.

Passage 1A: verbatim recall tendency = 1.00

(1) one day Ernu to giant armadillo; (2) he to his grandfather; (3) some of his poison arrows; (4) the village; (6) he into the forest; (7) he night on leaves in a; (8) was a; (9) and cave the; (10) at first he could see the river banks; (11) a; (12) the; (13) he the bow and arrows; (15) for; (16) he a swampy; (17) he looked around for a; (19) he; (22) the giant; (23) already; (24) the; (25) of the legendary; (26) he back the; (27) his tribe's village; (28) he showed to grandfather; (30) that he a fine.

Passage 1A: verbatim recall tendency <= 0.30

(4) visited; (5) and; (6) after this walked; (10) nothing except; (11) eventually noticed some off; (12) shape vanished; (15) animal's; (16) out; (18) before espying shadowy; (19) quickly* ; (24) among; (25) monster; (27) many.

Passage 2C: verbatim recall tendency = 1.00

(1) shave; (2) which always a breakfast; (3) I; (5) that a grating; (7) I had never heard before; (8) I the of; (9) to inside; (10) of metal; (11) and the; (12) I then friend; (13) who knew; (14) or he; (15) he said he the of the; (16) then; (17) of plastic the; (19) there left inside by; (20) table; (21) the sunlight; (22) me; (23) I; (24) to; (25) and the and razor blades; (27) I; 28) shave bathroom; (29) cut-throat hand; (30) with the window.

Passage 2C: verbatim recall tendency <= 0.30

(1) in trying; (3) found my surprise; (5) disturbing sound; (6) at* first* ; (9) look for anything; (10) when; (13) matters; (14) let; (17) whereupon some rattled to; (19) because then; (20) but placed; (23) found out; (25) how to manage; (27) walked disheartened; (30) tosing through.

Passage 3B: verbatim recall tendency = 1.00

(1) it was beautiful house; (2) had; (3) room; (4) Georgian ultramodern rooooms; (5) solid bath; (8) an; (9) crystal taps of te; (10) the kitchen; (11) one wall deep a small room; (12) and was self-cleaning; (13) the had; (14) the walls; (18) heating; (21) the architects the; (22) and in; (23) in; (24) next; (26) botanical gardens; (27) they planted exotic; (29) an the; (30) both and were their.

Passage 3B: verbatim recall tendency <= 0.30

(2) tried best; (3) represented; (4) immediately; (6) unbelievably; (8) was; (9) glittering projected from; (10) been uniquely fitted out; (11) housed a; (16) so that acquired; (20) due to; (22) had positioned; (25) site provided; (26) nurserymen; (28) distributing; (29) lend to* setting; (30) overjoyed.

APPENDIX 6.11: EXPERIMENT I: PASSAGES 1A, 2C AND 3B:

ALL WORDS RECALLED NONVERBATIM ON AT LEAST 8 OCCASIONS

Nonverb. recall freq.	Clause no.	Original word and verbatim recall freq.	Substitutions and frequencies
Passage 1A			
15	6	walked (2)	went (9), set off (3), left (1), wanders (1), proceeded (1).
13	25	monster (0)	it (4), beast (3), animal (2), armadillo (1), amtillado (sic) (1), creature (1), him (1)
12	5	and (3)	to (10), where (2)
12	4	visited (2)	went (11), goes (11)
12	18	espying (1)	saw (6), noticed (4), noticing (4), caught sight of (1)
12	12	vanished (1)	disappeared (4), moved (2), disappearing (1), disappear (1), run away (1), dashed (1)
11	11	noticed (4)	saw (6), made out (2), seeing (1), perceived (1), spread (1)
11	6	after this (0)	then (11)
9	26	bulk (9)	animal (2), hide (2), it (2), hulk (1), load (1), skin (1)
9	21	ran (4)	went (4), reached (2), going (2), got (1), sprang (1)
9	12	shape (2)	which (5), animal (1), hump (1), it (1), monster (1)
8	3	borrowed (9)	get (3), got (2), gave (1), obtained (1), collected (1)
8	24	Ernu (5)	he (8)
8	9	crept (4)	stepped (2), left (2), crawled (1), went (1), emerges (1), dashed (1)
8	27	after (4)	took (3), for (3), when (2)
8	15	animal's (3)	it (4), its (2), beast (1), armadillo (1)
Passage 2C			
17	27	walked (1)	went (12), returned (3), back at (1), arrived (1)
16	14	let (2)	led (4), purported (3), professed (3), would have (2), would like (1), liked (1), leads (1), was supposed (1)
16	5	disturbing (1)	strange (3), peculiar (2), curious (2), horrible (2), unusual (2), alarming (2), nasty (1), terrible (1), unpleasant (1)
15	13	matters (3)	things (13), thing (1), them (1)
14	17	rattled (3)	fell (14)
14	30	tossing (2)	threw (7), throwing (5), hurled (1), chucked (1)
14	25	manage without (1)	do without (2), not using (1), not to use (1), without using (1), got out of using (1), relinquished (1), dispensed with (1), given up (1), progressed from (1), done away with (1)
14	30	through (1)	out of (12), into (1), away (1)
14	17	whereupon (0)	and (12), on (1), when (1)
13	5	sound (4)	noise (13)
13	17	some (2)	several (10), a few (2), lots of (1)
12	12	shaved (6)	took (10) sought (1), ask (1)
12	17	to (5)	out (11), from (1)

Nonverb. recall freq.	Clause no.	Original word and verbatim recall freq.	Substitutions and frequencies
12	3	found (2)	hear (4), noticed (2), disturbed (2), heard (1), alarmed (1)
11	22	words (6)	said (4), told (4), some (2), piece (1)
11	29	getting out (5)	found (2), took (2), reached for (2), taking out (1), took out (1), taking (1), picking up (1), picked up (1)
11	23	found out (3)	learned (5), learnt (3), knew (2), realised (1)
11	10	when (1)	and (7), whereupon (3), then (1)
10	1	in (1)	whilst (3), while (3), on (2), as (1), and (1)
9	14	believe (9)	purported (3), professed (3), think (2), was supposed (1)
9	22	gave (9)	said (4), told (4), admonished (1)
9	8	took...off (8)	opened up (4), opened (1), opening (), shook (1), removed (1), examined (1)
9	19	couldn't have been (5)	could not be (2), couldn't be (2), could be (1), would be (1), must not be (1), was (1)
9	19	because (3)	as (3), for (2), since (2), whether (1), thinking (1)
9	19	then (2)	this time (5), now (3), this stage (1)
9	20	placed (1)	put (6), laid (3)
8	5	motor (9)	razor (7), it (1)
8	20	my friend (7)	he (8)
8	18	alarming (5)	worried (3), great concern (1), upset (1), wonder (1), shocked (1), discouraged (1)
8	1	trying (3)	started (1), got up (1), about (1), difficulty (1), attempting (1), preparing (1), deciding (1), proceeed (1)
8	3	surprise (0)	disturbed (3), alarned (2), amazed (1), startled (1), worried(1)

<u>Passsage 3B</u>

16	30	overjoyed (2)	delighted (6), very pleased (2), well pleased (1), most pleased (1), happy (1), certainly happy (1), very happy (1), extremely happy (1), very proud (1), very satisfied (1)
14	16	acquired (1)	give (10, had (2), render (1), given (1)
14	16	so that (0)	to (11), due to (1), so as to (1), thus (1)
13	2	tried (1)	taken (8), done (3), excelled (1), designed (1)
12	11	housed (1)	was (5), occupied (2), occupying (1), had (1), all doing (1), set in (1), took up (1)
12	29	lend (1)	give (4), gave (4), had (1), looked (1), like (1), giving (1)
11	26	nurserymen (4)	gardeners (7), workers (1), botanist (1), expertly (1), professionally (1)
10	2	their best (4)	much pain (1), the utmost pain (1), great care (1), a lot of care (1), every care (1), with great care (1), a good deal of trouble (1), considerable trouble (1), great trouble (1), excelled themselves (1)
9	24	as (7)	like (9)
9	4	immediately adjacent (6)	side by side (3), next to one another (2), all adjacent (2), in juxtaposition (1), next to each other (1)
9	5	installed (5)	fitted (4), was (3), produced (1), instated (1)

Nonverb. recall freq.	Clause no.	Original word and verbatim recall freq.	Substitutions and frequencies
9	6	unbelievably (2)	very (2), amazingly (2), exceptionally (2), almost (1), ultra (1), extremely (1)
9	20	due to (1)	because of (4), since (3), because (1), thus (1)
8	27	shrubs (5)	plants (6), trees (2)
8	9	from (4)	at (7), to (1)
8	10	had been (4)	was (8)
8	9	projected (1)	were (2), was (1), stood (), attached (1), adorned (1), protruded (1), poked out (1)
8	25	provided (0)	was (3), affected (2), gave (1), took (1), guarded (1)

APPENDIX 6.12: EXPERIMENT I: PASSAGES 1A, 2C AND 3B: NOTABLE INTRUSIONS

Intrusive words and phrases reproduced by at least two subjects

Passage	Clause no.	Intrusive words and phrases (and type)
1A	1	set out (i), go (out) (i)
	2	of all (i)
	6	the village (ii)
	7	found (ii)
	8	next (i), outside (ii)
	10	looking/looked (ii)
	11	dark, large, vague (all ii or iii)
	18	shallow (iv)
	19	poison/poisoned (iii)
	21	to where (ii)
	26	heavy, great, the village (all ii)
	27	it (ii), he (ii)
	30	new (iv), as a reward (ii)
2C	1	with my electric razor (ii or ii), I went to/into the bathroom (iii)
	5	electric (ii)
	12	of mine (ii), decided (i)
	14	he did (i)
	16	of the razor (ii)
	18	at/by this (i)
	19	the razor (ii or iii)
	23	he said (i), it was (i)
	25	water (iv)
	29	razor (ii), cupboard (iv)
	30	hand (i), old (iii or iv)
3B	4	style/styles (i or ii)
	5	the bathroom (ii or iv)
	6	system (i)
	9	two (ii)
	14	of the rooms (iii)
	17	also (i)
	18	the house (iii), room/rooms (iii)
	24	rather (i)
	25	house/houses (ii)
	27	garden (ii)

All intrusive phrases of 5 or more words in length

Passage	Clause no.	Intrusive words and phrases (and type)
1A	6	he wandered around for a while and thought (v)
	8	went in search of the armadillo (iii)
	11	but didn't realise at first that it was the giant armadillo (v); which afterwards only proved to be a figment of his imagination (v)
	19	but thought he had missed (v)
	21	to the place where he had fired his arrows at (ii); to where the shape was (ii or iii)
	25	decided to begin the task (i); the important thing was (ii or iv)
	26	and because he couldn't carry (v)
	30	as a reward for this great deed (ii)
2C	1	I went into/to the bathroom (iii); I stood before the mirror (iv or v); I went to the bathroom and took up the electric razor (iii)
	19	I was beginning to doubt (ii)
	23	he said that it was about time (i)
3B	2	so as to make it as convenient as possible (iii or iv)
	5	the bathroom was especially impressive (ii or iv)
	8	the whole bathroom being a model (ii or iv)
	12	in one of the rooms (iii)
	14	of one of the rooms (iii)
	26	to plan the enormous garden (ii or iv)
	27	also taken trouble over choosing (iii)
	29	rather like that of a...jungle (i)
	30	overall it was a very satisfactory house (i)

APPENDIX 6.13: EXPERIMENT II: PASSAGES 1A, 2C AND 3B: NOTABLE INTRUSIONS

All intrusive words and phrases of types (iv) and (v)

Passage and Condition	Clause no.	Intrusive words and phrases
1A/P	2	hut; saying goodbye
	5	for their protection
	7	camouflaged himself
	23	he need not have bothered
	24	get out his knife; drew his knife
1A/N	2	to tell him this; telling him that
	7	in the hut among skins
	8	of grunting
	23	unfortunately
	30	tribal
1A/L	2	house; the hut
	3	and spears
	4	in the centre
	7	of some tribe; he still hadn't found an armadillo
	8	rustly; coming from nearby
	11	away from the trees; silhouetted against the sky
	14	returned to the cave to fetch; and hastily collecting
	25	hauled out the body into the open; with his spear; used his knife; and took his knife; with his knife
	26	he wrapped up the hide
2C/P	5	no longer operated; nothing happened
	8	could get it to work; unplugged it
	11	but it still didn't operate
	12	after breakfast
	20	at the side
	29	the cupboard; and towel
2C/N	1	open the cupboard door
	12	decided to temporarily abandon the job
	21	showed me; pointed out spots; while examining it again
	27	in my car
	28	after breakfast
	29	from the cupboard
2C/L	4	I switched the razor off turned it on again
	12	thinking it best; not knowing what to do for the best
	13	mend razors
	15	when I told him about my razor; done to get the razor reworking
	20	showed me; pointed to
	22	when I asked
	25	and threw away my old one; older method; old-fashioned (2)
	26	on the skin
	27	by bus; that morning; that evening
	29	cabinet; his drawer; from the cupboard
3B/P	9	inlaid
	14	in the living room; each joint

Passage and Condition	Clause no.	Intrusive words and phrases
	16	for stength
	19	very efficient
3B/N	6	intricate
	14	get the shades right
	15	on their boundaries
	18	glass chandeliers
	30	honeymoon there
3B/L	2	with useful time-saving household equipment
	4	style that is all the rage these days
	6	rested on a marble base
	8	of the kitchen
	9	so as not detract from the overall impression
	16	mottled
	20	chemical composition
	26	Japanese

<u>All intrusive phrases of 5 or more words</u>

Passage and Condition	Clause no.	Intrusive words and phrases
1A/P	1	lived in a little village with his grandfather; was a member of a tribe
	23	byt the time he got there; he need not have bothered
	29	with what he had done
1A/N	7	in the hut among skins
	20	from out of the hole
	21	to the place where he shot
	22	to look at his find
	25	to take back to his tribe; then he realised he must
	26	when he had done this
	28	and when he got back
1A/L	7	he still hadn't found an armadillo
	14	returned to the cave to fetch
	19	and without seeing exactly what it was
	25	hauled out the body into the open; and he took his knife
	26	he wrapped up the hide
	27	as the village was quite far away
2C/P	8	could get it to work
	11	but it still didn't operate
	16	proceeded to take the shaver apart
	19	indeed all that one could see were
2C/N	1	I went into the bathroom; open the cupboard door and took out my electric razor
	12	decided to temporarily abandon the job
2C/L	1	I went along to the bathroom; I went into the bathroom
	2	that plagues certain of us

Passage and Condition	Clause no.	Intrusive words and phrases
	4	I switched the razor off turned it on again
	7	it was such an unusual noise
	10	I was surprised to see
	12	not knowing what to do for best
	15	when I told him about my razor; done to get the razor reworking
	22	what was wrong with it
	25	and threw away my old one
3B/P	5	particular care had been taken over the bathroom
	9	and of special interest were
	11	that it took the space
	22	the overall picture was magnificent
	25	to suit the size of the house
3B/N	2	to get the shades right
	5	the bathroom was a wonder to behold
	30	who were to move in; thus it wasa wonderful
3B/L	2	to providethe maximum comfort; with useful time-saving household equipment
	3	to give a varied effect
	4	style that is much the rage these days
	5	done their best to make the bathroom as pleasing as possible in appearance
	6	rested on a marble base
	9	so as not to detract from the overall impression
	20	at which they were maintained

APPENDIX 6.14: EXPERIMENT II: PASSAGES 1A, 2C AND 3B:

NUMBERS OF NOTABLE INTRUSIONS

		Passage 1A		Passage 2C		Passage 3B	
Cond- ition	Subj. no.	types iv, v	5 or more words	types iv, v	5 or more words	types iv, v	5 or more words
P	2	1	0	1	2	0	2
	3	0	0	1	0	1	0
	7	2	0	1	1	1	1
	8	0	1	1	0	2	0
	14	0	1	0	0	0	0
	18	2	1	0	0	1	1
	23	2	0	0	0	0	0
	26	0	0	1	0	0	0
	29	1	1	0	0	0	0
	32	0	0	2	0	0	0
	35	0	0	0	0	0	0
	36	0	1	2	1	0	1
N	5	0	1	1	0	0	0
	6	0	0	0	0	0	0
	9	1	1	1	0	2	2
	11	1	1	0	0	0	0
	13	1	0	3	3	0	0
	16	1	1	0	0	1	0
	19	1	1	1	0	0	1
	20	0	0	0	0	0	0
	22	1	1	0	0	0	0
	24	0	2	1	0	2	1
	25	0	0	1	0	0	0
	28	0	0	0	0	0	0
L	1	3	0	2	1	0	0
	4	2	1	2	0	2	0
	10	0	0	1	1	0	0
	12	3	0	3	1	0	0
	15	1	1	1	1	0	0
	17	1	0	0	0	1	0
	21	1	0	3	0	1	1
	27	1	1	3	4	2	4
	30	1	1	0	1	0	0
	31	2	0	1	0	0	1
	33	2	2	3	1	1	1
	34	1	1	1	1	1	1

APPENDIX 6.15: EXPERIMENT III: PASSAGES 1 AND T: ALL INTRUSIONS OF TYPES IV AND V

Passage S

Condition	Clause no.	Intrusive words and phrases
1	10	fluttering towards the tree
	11	began to sing
	21	like an idiot
	23	in doing so made a noise
	27	all at once the quintessence of beauty
2R	1	went out into the country
	3	drying out
	4	around a tree
	5	which was reported to be in the area
	11	perched on a branch
	14	friends
	17	to the end
	19	making them appear silver
	21	like a cretin
	25	frightened off the bird which should have been
	26	thought "Oh well"; cursed
	28	which at the shock of seeing the bird fly off
2N	2	the man had a great deal of trouble
	3	by a cave
	5	to try as he had wanted for a long time
	6	walked up
	8	he was as silent as possible
	9	no sound came from the valley; he sat there a long time hidden
	12	she was obviously ready to mate
	15	actually believes the call would result in him being held in great esteem by fellow bird-watchers
	16	had checked it all
	17	among some bushes
	23	my foot caught the tape-recording equipment and brought part of it crashing to the ground...so the equipment was finished - destroyed
	25	his mission was successful; te cry that I had been wanting to tape for so long; the only bird he managed to record was
	28	for a brief moment of pure delight; compared; he did not feel resentment at missing the recording only
	29	wonders whether next year he will be able to locate another pied-tail crow's nest

Passage T

Condition	Clause no.	Intrusive words and phrases
1	1	for his birthday; for Christmas
	7	moved
	16	so she called; who had been working
	18	when he had been given a car
	19	to do so by bending the wires

Cond-ition	Clause no.	Intrusive words and phrases
	26	on the carpet
	28	returned to the garden (2)
2R	1	for his birthday (2); birthday; red
	2	of the front room
	11	Daddy
	15	she then called
	16	who was pottering around
	28	returned to the garden (2); Tom went back to the garden; after giving him something else to play with; promised to buy him another one
2N	1	for his birthday; for Christmas; Willy excitedly opened it and found; came into the house with a broad grin on his face; called his nephew...to...him; it was clockwork and so when wound up would go round on its own; in the dining room
	2	Willy was at his own house not Uncle Bill's at the time; then ran off and started
	5	more destructive
	7	causing its motion
	9	as Willy was curiously pulling his toy to pieces; whilst they were in motion; whilst trying to mend it
	10	through one of the opening doors
	11	Daddy; filled the house; went to his parents
	12	said that he shouldn't mess about with the mechanisms of his toys as he might hurt himself
	15	using force much to the discomfort of Willy
	16	so she called; who was visiting
	25	when he relaxed
	26	wouldn't want to play; they managed to calm down the frightened little boy; went back to playing with his other toys; soon forgot his ordeal and began to play again
	27	on the dining room floor
	28	refused to buy him another one however much he cried; soon he was quite happily playing with it again
	30	to recover the remains of her cooking

APPENDIX 6.16: EXPERIMENT III: PASSAGES S AND T: NUMBERS OF NOTABLE INTRUSIONS

		Session 1		Session 2R		-----Session 2N-----		
Pass.	Subj. no.	types iv, v	5 or more words	types iv, v	5 or more words	Subj. no.	types iv, v	5 or more words
S	1	0	3	0	2	5	0	2
	2	2	2	4	1	6	1	9
	3	0	2	0	2	7	0	1
	4	0	0	0	0	8	0	2
	13	0	0	1	1	9	1	5
	14	1	4	0	3	10	4	5
	15	0	1	0	0	11	0	3
	16	0	0	1	0	12	1	4
	17	0	2	0	1	21	0	2
	18	0	1	3	3	22	1	0
	19	0	0	0	1	23	4	9
	20	2	1	3	5	24	2	7
	29	0	0	0	2	25	1	1
	30	0	0	0	1	26	1	2
	31	0	2	0	3	27	0	1
	32	0	0	1	0	28	4	2
T	5	0	0	2	0	1	2	2
	6	1	1	3	3	2	6	5
	7	1	0	0	1	3	0	1
	8	1	3	1	3	4	0	0
	9	1	3	3	3	13	3	2
	10	1	3	1	3	14	5	5
	11	0	0	0	0	15	1	1
	12	1	1	1	2	16	0	1
	21	1	2	1	1	17	2	1
	22	0	2	0	1	18	1	1
	23	1	1	0	1	19	0	0
	24	0	2	0	3	20	4	4
	25	1	0	1	1	29	3	2
	26	1	2	0	0	30	1	1
	27	0	0	0	1	31	1	6
	28	0	0	0	0	32	2	0